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(54) A REFRIGERATOR COMPRISING A MACHINE ROOM

KÜHLSCHRANK MIT EINEM MASCHINENRAUM

RÉFRIGÉRATEUR COMPRENANT UN ESPACE DÉDIÉ AUX MACHINES

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(56) References cited:
EP-A2- 0 345 437
DE-A1-102009 026 668
US-A1- 2006 000 231
US-A1- 2010 300 137

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Description

[0001] The present invention relates to a refrigerator comprising a machine room.

[0002] In refrigerators with modular machine rooms, all of the cooling system components (compressor, condenser, fan and evaporator) are disposed in a machine room. These cooling system components are disposed below or above the refrigerator cabin. The components that become cold or hot in the machine room are separated from each other by means of an insulated wall. There is humidity and heat entry into the compartment during operation of the refrigerator due to different loads/outer environment operating conditions. Rapid cooling is performed by delivering cold air into the compartment wherein there is humidity and heat inflow. However, meanwhile, the other compartments are overcooled by being under the effect of cold air. Therefore, both energy consumption increases and also the foodstuffs in the compartment without inflow of humidity and heat are damaged from cold.

[0003] In the state of the art Korean Patent Document No. KR20100059442, a refrigerator is described that comprises a valve which provides the controlling of the flow of cold air into different compartments.

[0004] DE 10 2009 026 668 A1 discloses a refrigerator according to the preamble of claim 1.

[0005] The aim of the present invention is the realization of a refrigerator, the cooling efficiency of which is increased.

[0006] The refrigerator realized in order to attain the aim of the present invention and explicated in the claims, comprises a freezing compartment, a fresh food compartment, a machine room, at least a first air channel providing the cold air coming from the machine room to be delivered into the freezing compartment by passing through the fresh food compartment and having pumping holes at the portion disposed in the freezing compartment, allowing passage of air into the freezing compartment and at least at least a second air channel, with one portion being disposed in the freezing compartment and having suction holes thereon, performing aspiration of the air in the freezing compartment, allowing the air circulating in the freezing compartment to be delivered into the machine room.

[0007] The refrigerator of the present invention furthermore comprises:

- at least one connection point between the end of the first air channel remaining in the freezing compartment and the second air channel and
- at least one valve enabling the air flow between the air channels to be controlled.

[0008] In an embodiment of the present invention, the freezing compartment is disposed at the top and the fresh food compartment at the bottom. The cold air coming from the fresh food compartment is delivered to the first air channel. The first air channel extends into the freezing compartment by passing from the rear of the fresh food compartment. The fresh food compartment is provided to be cooled by the cold wall effect by means of the portion of the first air channel remaining behind the fresh food compartment wall. Passage of cold air into the freezing compartment is provided by means of the pumping holes in the portion of the first air channel remaining in the freezing compartment. The freezing compartment is cooled by means of the cold air delivered therein. The air circulating in the freezing compartment passes into the portion of the second air channel remaining in the freezing compartment by means of the suction holes. Passage of air from the portion of the second air channel remaining in the freezing compartment to the portion between the connection point of the second air channel and the fresh food compartment is regulated by the valve. In the case the connection point is closed by the valve, there is no passage of air from the portion of the second air channel remaining in the freezing compartment to the portion between the connection point of the second air channel and the fresh food compartment. Therefore, passage of air from the freezing compartment into the second air channel and the circulation of air in the freezing compartment stops in the course of time. Therefore, pumping of air into the freezing compartment from the first air channel stops in the course of time. Meanwhile, the cold air received from the fresh food compartment passes from the first air channel to the portion of the second air channel situated between the connection point and the machine room before being pumped into the freezing compartment.

[0009] In an embodiment of the present invention, the refrigerator comprises at least one sensor that provides the measurement of the temperature values and at least one control unit which regulates the movement of the valve depending on the measured temperature value.

[0010] In an embodiment of the present invention, the refrigerator comprises at least one motor that enables the valve to open/close the connection point. The valve moves in front of the connection point by means of the energy received from the motor.

[0011] In an embodiment of the present invention, the refrigerator comprises at least one cover that regulates passage of air from the machine room into the first air channel.

[0012] In an embodiment of the present invention, the refrigerator comprises the first air channel and the second air channel providing the formation of a closed cold air circulation around the fresh food compartment. When passage of air from the first air channel into the second air channel is prevented by the valve, the passage of cold air into the freezing compartment is prevented. Thus, the fresh food compartment is cooled with the cold air passing through the channels disposed behind the fresh food compartment wall.

[0013] In another embodiment of the present invention, the refrigerator comprises at least one separator providing the portion of the first air channel remaining in the

fresh food compartment to be divided in the vertical axis and a cover disposed between the wall of the first air channel facing the fresh food compartment and the separator.

[0014] In a derivative of this embodiment, the control unit provides the cover to move between the wall of the first air channel facing the fresh food compartment and the separator. Thus, the cooling load is transferred to the freezing compartment and the fresh food compartment is prevented from overcooling during rapid cooling of the freezing compartment.

[0015] By means of the present invention, a refrigerator is realized wherein the air delivered from the machine room to the compartments is controlled. Consequently, while a compartment is rapidly cooled, the other compartment is prevented from rapid cooling and unnecessary energy consumption is prevented.

[0016] The model embodiments relating to the refrigerator realized in order to attain the aim of the present invention are illustrated in the attached figures, where:

Figure 1 - is the schematic view of a refrigerator.
Figure 2 - is the rear schematic view of a refrigerator while the valve is open.
Figure 3 - is the rear schematic view of a refrigerator while the valve is closed.
Figure 4 - is the rear schematic view of a refrigerator while the cover is closed.

[0017] The elements illustrated in the figures are numbered as follows:

1. Refrigerator
2. Freezing compartment
3. Fresh food compartment
4. Compressor
5. Condenser
6. Evaporator
7. Fan
8. Machine room
9. First air channel
10. Second air channel
11. Connection point
12. Pumping holes
13. Suction holes
14. Valve
15. Sensor
16. Control unit
17. Motor
18. Cover
19. Separator

[0018] The refrigerator (1) comprises at least one freezing compartment (2) wherein objects desired to be stored for a long time are placed, at least one fresh food compartment (3) wherein fresh foods and beverages are placed, a machine room (8) having a compressor (4) providing the refrigeration cycle to be performed, a condenser (5) providing the refrigerant fluid to be condensed, an evaporator (6) providing the cooling by absorbing the thermal energy from the environment and at least one fan (7) providing the cooled air to be sucked, at least one first air channel (9), one end connected to the machine room (8), extending to the freezing compartment (2) by passing from the fresh food compartment (3), having pumping holes (12) at its portion disposed in the freezing compartment (2) allowing passage of air and at least one second air channel (10), with some portion disposed in the freezing compartment (2), connected to the machine room (8) by passing from the fresh food compartment (3), having suction holes (13) at the portion disposed in the freezing compartment (2), providing the air circulating in the freezing compartment (2) to be aspirated and transferred into the machine room (8) (Figure 1).

[0019] The refrigerator (1) of the present invention comprises

- a connection point (11) disposed after the suction holes (13) on the second air channel (10) in the flow direction, where the end of the first air channel (9) remaining in the freezing compartment (2) is connected to the second air channel (10) such that there is air flow therebetween,
- at least one valve (14) enabling air flow to be controlled at the connection point (11) (Figure 2).

[0020] The fresh food compartment (3) is disposed between the machine room (8) and the freezing compartment (2). The cold air passing from behind the fresh food compartment (3) wall is delivered into the freezing compartment (2) by means of the pumping holes (12) disposed on the first air channel (9). Meanwhile, the fresh food compartment (3) is cooled by the cold wail effect. The air circulating the freezing compartment (2) provides the cooling of the freezing compartment (2). The air filling the freezing compartment (2) comes to the portion of the second air channel (10) remaining in the freezing compartment (2) by means of the suction hole (13). The air passing from the compartments (2, 3) to the connection point (11) is regulated by means of the valve (14).

[0021] In the case the temperature of the freezing compartment (2) rises, the connection point (11) is almost entirely opened by means of the valve (14). Thus, air aspiration from the suction hole (13) continues and air passage is provided to the freezing compartment (2) from the pumping holes (12). Furthermore, delivery of cold air into the freezing compartment (2) continues by the connection point (11) remaining almost entirely open and the cold air is prevented from overcooling the fresh food compartment (3). Thus, unnecessary energy consumption is prevented.

[0022] In the case objects are loaded into the fresh food compartment (3), passage of air to the connection point (11) from the end of the second air channel (10) facing the connection point (11) is prevented by means of the valve (14) in order to rapidly cool the fresh food

compartment (3). In the case passage of air to the connection point (11) from the end of the second air channel (10) facing the connection point (11) is prevented, aspiration of air from the suction holes (13) into the second air channel (10) stops. Meanwhile, flow of cold air from the machine room (8) into the first air channel (9) continues. However, the amount of air passing from the first air channel (9) into the freezing compartment (2) decreases since the inner volume of the freezing compartment (2) is filled with cold air. The air coming from the first air channel (9) returns back to the machine room (8) by passing from the connection point (11).

[0023] In an embodiment of the present invention, the refrigerator (1) comprises at least one sensor (15) that provides the measurement of the temperature values and at least one control unit (16) which regulates the movement of the valve (14) depending on the data received from the sensor (15). The temperature values of the fresh food compartment (3) and/or the freezing compartment (2) are detected by means of the sensor (15). The control unit (16) regulates the movement of the valve (14) in accordance with the values received from the sensor (15) and the values predefined in its memory.

[0024] In an embodiment of the present invention, the refrigerator (1) comprises a motor (17) that provides the valve (14) to be moved. The temperatures of the fresh food compartment (3) and the freezing compartment (2) are detected by the sensor (15). In case hot objects are loaded into the fresh food compartment (3), the temperature value of the fresh food compartment (3) rises. This value detected by means of the sensor (15) is evaluated by the control unit (16) and the valve (14) is moved by the motor (17) and passage of air from the end of the second air channel (10) facing the connection point (11) into the connection point (11) is prevented by means of the valve (14) (Figure 2).

[0025] In an embodiment of the present invention, the refrigerator (1) comprises the first air channel (9) and the second air channel (10) that enable the formation of a closed cold air circulation around the fresh food compartment (3) by preventing the air aspirated from the freezing compartment (2) from passing through the connection point (11) by means of the valve (14) depending on the data received from the sensor (15). In order to cool the fresh food compartment (3) rapidly, the end of the second air channel (10) facing the connection point (11) is almost entirely closed by means of the valve (14). Continuous cold air circulation is provided around the fresh food compartment (3) by closing the connection point (11). Consequently, the cooling load is given to the fresh food compartment (3) (Figure 3).

[0026] In another embodiment of the present invention, the refrigerator (1) comprises at least one separator (19) providing the portion of the first air channel (9) remaining in the fresh food compartment (3) to be divided in the vertical axis and a cover (18) disposed between the wall of the first air channel (9) facing the fresh food compartment (3) and the separator (19). While the cover (18) is closed, the air delivered from the machine room (8) is prevented from passing through the portion of the first air channel (9) facing the fresh food compartment (3). Consequently, overcooling of the fresh food compartment (3) is prevented, cooling load is given to the freezing compartment (2) and rapid cooling of the freezing compartment (2) is provided (Figure 4, Figure 5).

[0027] In a derivative of this embodiment, the control unit (16) provides the cover (18) to be moved. While the cover (18) is open, the air delivered from the machine room (8) passes through the entire first air channel (9). While the fresh food compartment (3) is provided to be cooled with the cold wall effect by means of the air coming from the machine room (8) passing through the portion of the first air channel (9) facing the fresh food compartment (3), the air passes into the freezing compartment (2) by means of the pumping holes (12) at the portion of the first air channel (9) remaining in the freezing compartment (2). While the cover (18) is closed, the air delivered from the machine room (8) is prevented from passing through the portion of the first air channel (9) facing the fresh food compartment (3). Consequently, overcooling of the fresh food compartment (3) is prevented, cooling load is given to the freezing compartment (2) and rapid cooling of the freezing compartment (2) is provided (Figure 4, Figure 5).

[0028] The refrigerator (1) of the present invention comprises the connection point (11) and the valve (14) that allows the differentiation of the cooling load given to the compartments (2, 3) with the cold air received from the machine room (8) in accordance with temperature parameters of the compartments (2, 3). Thus, by giving cooling load to the compartment (2 or 3) with rising temperature, overcooling of the other compartment (2 or 3) is prevented and unnecessary energy consumption is prevented.

[0029] It is to be understood that the present invention is not limited to the embodiments disclosed above and a person skilled in the art can easily introduce different embodiments. These should be considered within the scope of the protection postulated by the claims of the present invention.

Claims

1. A refrigerator (1) comprising at least one freezing compartment (2) wherein objects desired to be stored for a long time are placed, at least one fresh food compartment (3) wherein fresh foods and beverages are placed, a machine room (8) having a compressor (4) providing the refrigeration cycle to be performed, a condenser (5) providing the refrigerant fluid to be condensed, an evaporator (6) providing the cooling by absorbing the thermal energy from the environment and at least one fan (7) providing the cooled air to be sucked, at least one first air channel (9), with one end connected to the machine room

(8), extending to the freezing compartment (2) by passing from the fresh food compartment (3), having pumping holes (12) at its portion disposed in the freezing compartment (2) allowing passage of air and at least one second air channel (10), with some portion disposed in the freezing compartment (2), connected to the machine room (8) by passing from the fresh food compartment (3), having suction holes (13) at its portion disposed in the freezing compartment (2) providing the air circulating in the freezing compartment (2) to be aspirated and transferred into the machine room (8),
characterized by

- a connection point (11) disposed after the suction holes (13) on the second air channel (10) in the flow direction, where the end of the first air channel (9) remaining in the freezing compartment (2) is connected to the second air channel (10) such that there is air flow therebetween and
- at least one valve (14) enabling the air flow at the connection point (11) to be controlled.

2. A refrigerator (1) as in Claim 1, **characterized by** at least one sensor (15) that provides the measurement of the temperature values and at least one control unit (16) which regulates the movement of the valve (14) depending on the data received from the sensor (15).

3. A refrigerator (1) as in Claim 1 or 2, **characterized by** a motor (17) that provides the valve (14) to be moved.

4. A refrigerator (1) as in any one of the Claims 2 or 3, **characterized by** the first air channel (9) and the second air channel (10) that enable the formation of a closed cold air circulation around the fresh food compartment (3) by preventing the air aspirated from the freezing compartment (2) from passing through the connection point (11) by means of the valve (14) depending on the data received from the sensor (15).

5. A refrigerator (1) as in any one of the above Claims, **characterized by** at least one separator (19) providing the portion of the first air channel (9) remaining in the fresh food compartment (3) to be divided in the vertical axis and a cover (18) disposed between the wall of the first air channel (9) facing the fresh food compartment (3) and the separator (19).

6. A refrigerator (1) as in Claim 5, **characterized by** the control unit (16) that provides the cover (18) to be moved.

Patentansprüche

1. Kühlschrank (1), umfassend wenigstens ein Gefrierfach (2), in das Artikel gelegt werden, die für lange Zeit aufbewahrt werden sollen, wenigstens ein Frischhaltefach (3), in das frische Lebensmittel und Getränke gelegt werden, einen Maschinenraum (8) mit einem Kompressor (4), der dafür sorgt, dass der Kühlzyklus ausgeführt wird, einen Kondensator (5), der dafür sorgt, dass das Kühlfluid verdichtet wird, einen Verdampfer (6), der die Kühlung bereitstellt, indem er die Wärmeenergie von der Umgebung absorbiert, und wenigstens ein Gebläse (7), das dafür sorgt, dass die gekühlte Luft angesaugt wird, wenigstens einen ersten Luftkanal (9), dessen eines Ende mit dem Maschinenraum (8) verbunden ist und der sich zum Gefrierfach (2) erstreckt, indem er vom Frischhaltefach (3) aus verläuft, und Pumplöcher (12) an seinem im Gefrierfach (2) angeordneten Abschnitt aufweist, die das Durchtreten von Luft zulassen, und wenigstens einen zweiten Luftkanal (10), von dem ein Abschnitt im Gefrierfach (2) angeordnet ist und der mit dem Maschinenraum (8) verbunden ist, indem er vom Frischhaltefach (3) aus verläuft, und Ansauglöcher (13) an seinem im Gefrierfach (2) angeordneten Abschnitt aufweist, die dafür sorgen, dass die Luft, die im Gefrierfach (2) zirkuliert, angesaugt und in den Maschinenraum (8) übertragen wird,
dadurch gekennzeichnet, dass

- einen Verbindungspunkt (11), der in Strömungsrichtung nach den Ansaugöffnungen (13) am zweiten Luftkanal (10) angeordnet ist, wobei das Ende des ersten Luftkanals (9), das im Gefrierfach (2) verbleibt, mit dem zweiten Luftkanal (10) verbunden ist, derart, dass ein Luftstrom dazwischen vorliegt, und
- wenigstens ein Ventil (14), das ein Steuern des Luftstroms am Verbindungspuntk (11) ermöglicht.

2. Kühlschrank (1) nach Anspruch 1, **gekennzeichnet durch** wenigstens einen Sensor (15), der für das Messen der Temperaturwerte sorgt, und wenigstens eine Steuereinheit (16), die die Bewegung des Ventils (14) abhängig von den vom Sensor (15) empfangenen Daten reguliert.

3. Kühlschrank (1) nach Anspruch 1 oder 2, **gekennzeichnet durch** einen Motor (17), der für das Bewegen des Ventils (14) sorgt.

4. Kühlschrank (1) nach einem der Ansprüche 2 oder 3, **dadurch gekennzeichnet, dass** der erste Luftkanal (9) und der zweite Luftkanal (10) das Bilden einer geschlossenen Kaltluftzirkulation um das Frischhaltefach (3) ermöglichen, indem sie mithilfe

des Ventils (14) abhängig von den vom Sensor (15) empfangenen Daten verhindern, dass die vom Gefrierfach (2) angesaugte Luft durch den Verbindungspunkt (11) tritt.

5. Kühlschrank (1) nach einem der vorangehenden Ansprüche, **gekennzeichnet durch** wenigstens einen Separator (19), der dafür sorgt, dass der Abschnitt des ersten Luftkanals (9), der im Frischhaltefach (3) bleibt, an der vertikalen Achse geteilt ist, und eine Abdeckung (18), die zwischen der Wand des ersten Luftkanals (9), die dem Frischhaltefach (3) zugewandt ist, und dem Separator (19) angeordnet ist.

6. Kühlschrank (1) nach Anspruch 5, **dadurch gekennzeichnet, dass** die Steuereinheit (16), der für das Bewegen der Abdeckung (18) sorgt.

Revendications

1. Un réfrigérateur (1) comprenant au moins un compartiment de congélation (2) dans lequel les objets, que l'on désire stocker pendant une longue période, sont placés, au moins un compartiment d'aliments frais (3) dans lequel des aliments frais et des boissons sont placés, une chambre machine (8) présentant un compresseur (4) permettant la réalisation du cycle de réfrigération, un condenseur (5) permettant la condensation du fluide frigorigène, un évaporateur (6) permettant le refroidissement en absorbant l'énergie thermique de l'environnement et au moins un ventilateur (7) permettant l'aspiration de l'air refroidi, au moins un premier canal d'air (9), dont une extrémité est reliée à la chambre machine (8), qui s'étend vers le compartiment de congélation (2) en passant à travers le compartiment d'aliments frais (3) et qui présente des trous de pompage (12) à sa partie située dans le compartiment de congélation (2), permettant le passage de l'air, et au moins un deuxième canal d'air (10), dont une partie est disposée dans le compartiment de congélation (2), qui est reliée à la chambre machine (8) en passant à travers le compartiment d'aliments frais (3), qui présente des trous d'aspiration (13) à sa partie située dans le compartiment de congélation (2), permettant l'aspiration de l'air circulant dans le compartiment de congélation (2) et son transfert dans la chambre machine (8), **caractérisé par**

- un point de raccordement (11) qui est situé après les trous d'aspiration (13) sur le deuxième canal d'air (10) dans la direction d'écoulement, où l'extrémité du premier canal d'air (9) restant dans le compartiment de congélation (2) est reliée au deuxième canal d'air (10) de telle sorte qu'il y a un écoulement d'air entre eux, et
- au moins une soupape (14) qui permet le contrôle de l'écoulement d'air au point de raccordement (11).

2. Un réfrigérateur (1) selon la Revendication 1, **caractérisé par** au moins un capteur (15) qui permet la mesure des valeurs de température et au moins une unité de commande (16) qui régule le mouvement de la soupape (14) en fonction des données reçues du capteur (15).

3. Un réfrigérateur (1) selon la Revendication 1 ou 2, **caractérisé par** un moteur (17) qui permet le déplacement de la soupape (14).

4. Un réfrigérateur (1) selon l'une quelconque des revendications 2 ou 3, **caractérisé par** le premier canal d'air (9) et le deuxième canal d'air (10) qui permettent la formation d'une circulation fermée de l'air froid autour du compartiment d'aliments frais (3) en empêchant l'air aspiré à partir du compartiment de congélation (2) de passer à travers le point de raccordement (11) par l'intermédiaire de la soupape (14) en fonction des données reçues du capteur (15).

5. Un réfrigérateur (1) selon l'une quelconque des revendications précédentes, **caractérisé par** au moins un séparateur (19) qui permet la séparation de la partie du premier canal d'air (9) restant dans le compartiment d'aliments frais (3) dans l'axe vertical, et un couvercle (18) qui est disposé entre la paroi du premier canal d'air (9) faisant face au compartiment d'aliments frais (3) et le séparateur (19).

6. Un réfrigérateur (1) selon la Revendication 5, **caractérisé par** l'unité de commande (16) qui permet le déplacement du couvercle (18).

Figure 2

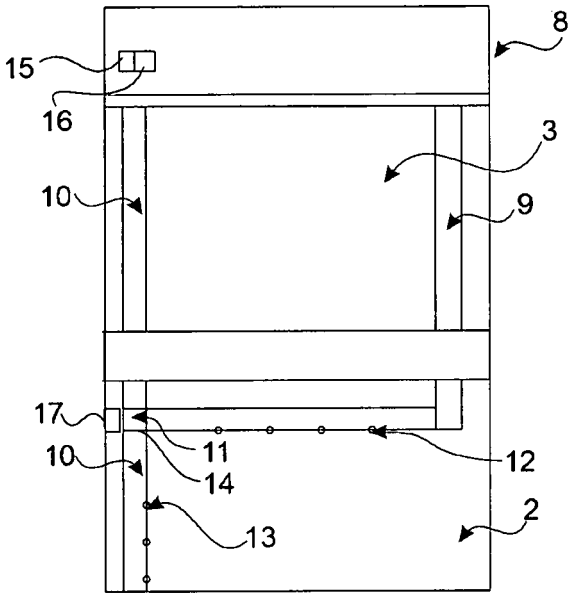


Figure 3

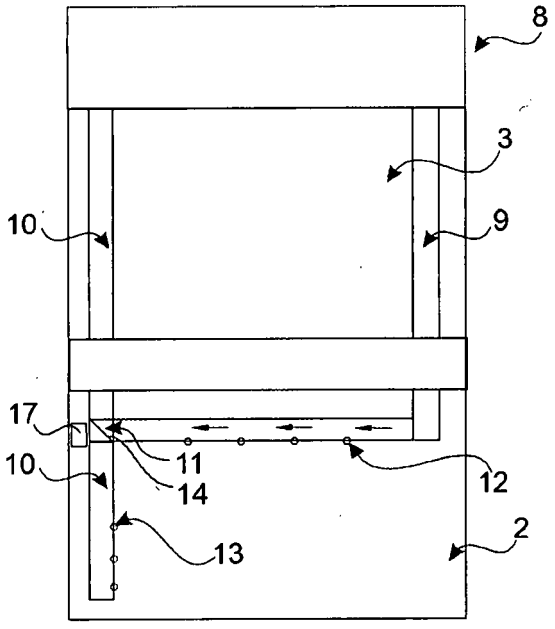


Figure 4

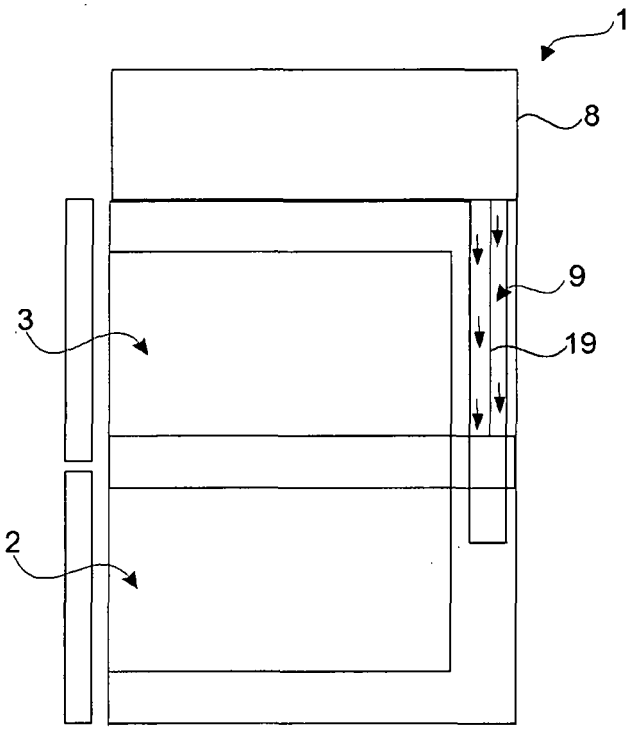


Figure 5

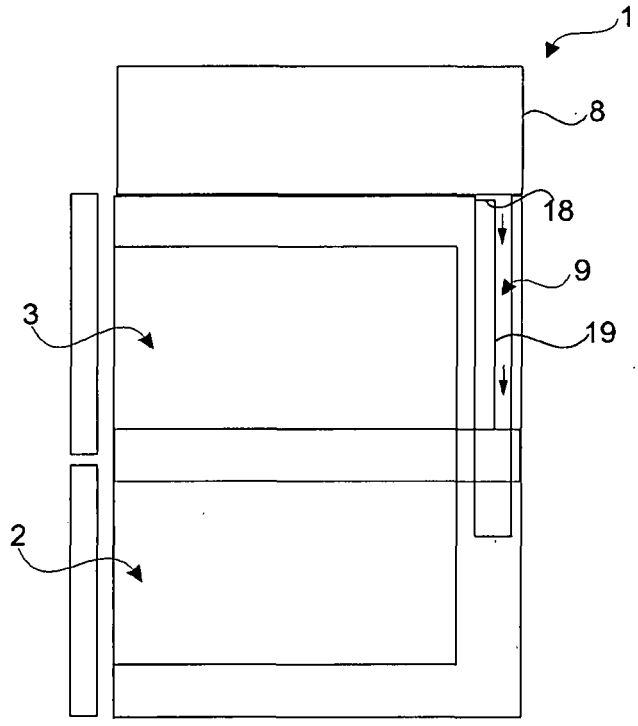
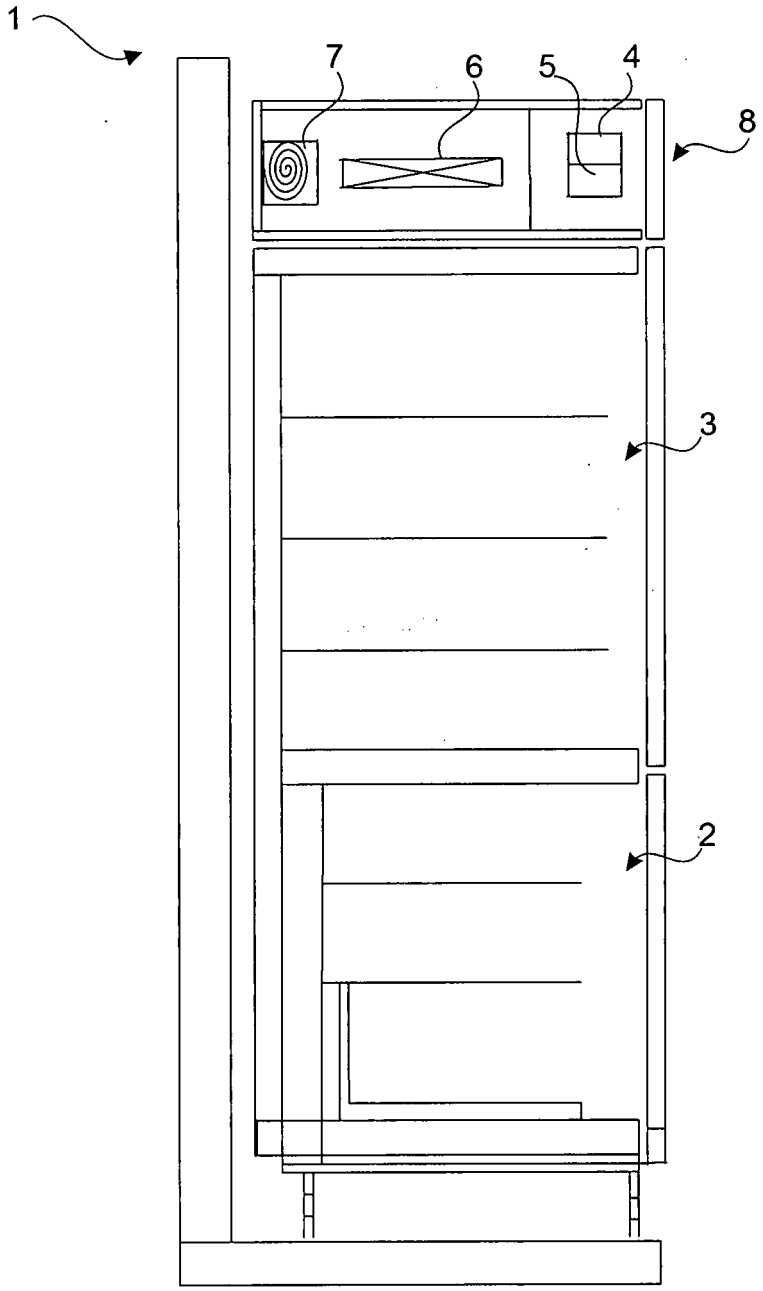


Figure 1



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Patent documents cited in the description

- KR 20100059442 **[0003]**
- DE 102009026668 A1 **[0004]**