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(71) Applicant: **Indesit Company S.p.A.**
60044 Fabriano (AN) (IT)

(72) Inventors:
- **Fioretti, Gabriele**
  I-60044, Fabriano (AN) (IT)
- **Grelloni, Alessio**
  I-62025, Fiuminata (MC) (IT)

(74) Representative: **Dini, Roberto**
Metroconsult S.r.l.
Via Sestriere 100
10060 None (Torino) (IT)

(54) Refrigerating appliance

(57) The invention relates to a freezer appliance (1) intended for domestic use or anyway primarily for food preservation, wherein the circulation of the refrigerating fluid within the evaporator (8) is regulated by a solenoid valve (7) which lets the fluid circulate within either the entire evaporator or just a portion thereof, depending on the load being present inside the appliance.

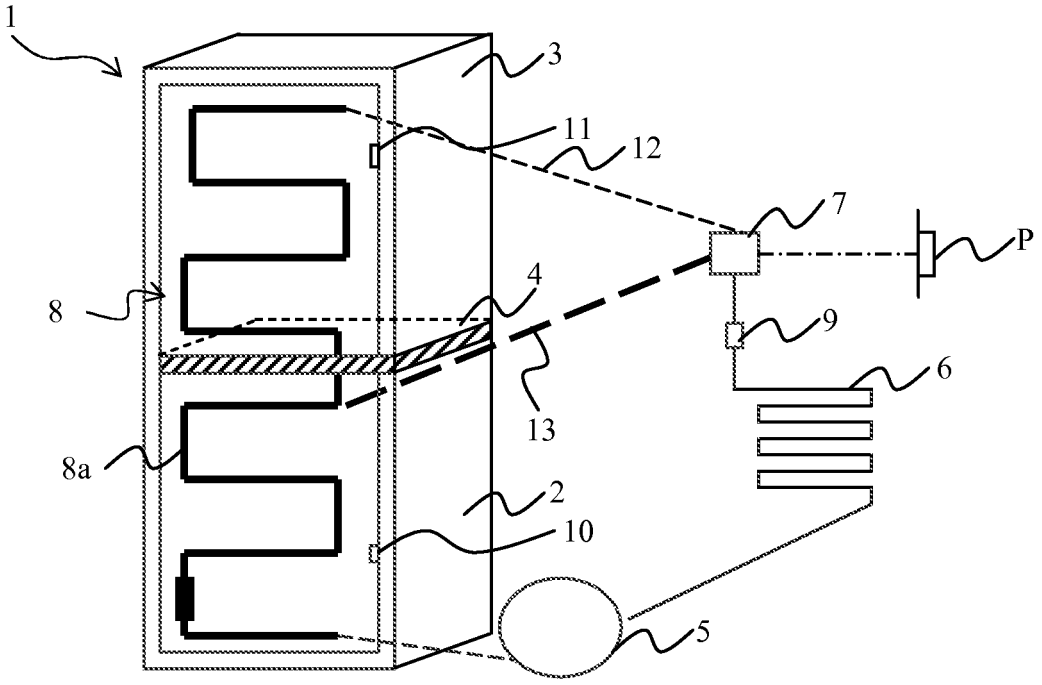

Fig. 1

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Description

[0001] The present invention relates to a refrigerating appliance according to the preamble of the first claim, and typically applies to freezers and refrigerator-freezers used for preserving and/or storing foodstuffs.

[0002] It should be stated beforehand that, in the present description and in the following claims, the term freezer (as well as refrigerator-freezer) refers to refrigerating appliances operating at temperatures below 0 °C, preferably between -5 °C and -30 °C.

[0003] An important aspect related to the operation of these appliances is the variability of the load placed therein; in fact, in normal household applications the quantity of foodstuffs preserved in the freezer may change considerably over one or more weeks.

[0004] As a matter of fact, the freezer is usually full of foodstuffs immediately after shopping, and is then gradually emptied within 1-2 weeks, so that the operating conditions of the appliance may change significantly between the beginning and the end of this time interval.

[0005] Of course, the freezer and its refrigerating circuit are nonetheless sized for the hardest operating conditions, which implies that they are not sized appropriately for small loads in the refrigerated compartment.

[0006] In fact, when the load occupies only a limited portion of the volume of the freezer compartment, the refrigerating circuit still operates as if the freezer compartment were completely filled with foodstuffs. This leads to a much higher energy consumption than would theoretically be required for preserving those foodstuffs properly.

[0007] The present invention therefore aims at improving this state of the art by providing a refrigerating appliance of the freezer or refrigerator-freezer type having suitable features which ensure a reduction in energy consumption as the load conditions change.

[0008] The idea based on which said object is attained is to provide a refrigerating appliance wherein the refrigerating fluid flow within the evaporator can be partialized, i.e. controlled in such a way that the fluid can flow through the entire evaporator or just a portion thereof, thus exchanging heat with a predetermined zone of the freezer compartment.

[0009] According to a preferred embodiment, the freezer compartment is divided into separate compartments, and said partialization lets the fluid circulate within the evaporator portion that exchanges heat with one or more of said compartments.

[0010] The features of the invention are set out specifically in the appended claims; said features and the advantages obtained therefrom will become more apparent from the following description concerning a non-limiting example of the invention.

[0011] Said example is illustrated in the diagram of Fig. 1, which is the only drawing annexed hereto.

[0012] As shown, in said drawing reference number 1 designates as a whole a freezer according to the invention, which in this example is a front-loading ("up"), static (without forced air circulation) freezer; the inner compartment of freezer 1 is divided into two compartments 2, 3 which are separated by a partition wall 4 made from insulating material (polystyrene or the like). Partition wall 4 may advantageously be a removable component of freezer 1, so that the latter can be cleaned more easily.

[0013] The two compartments may be accessible to the user by means of a single door or two distinct doors.

[0014] Freezer 1 has a refrigerating circuit which comprises a compressor 5, a condenser 6, a valve 7 (preferably a solenoid valve) and an evaporator 8; preferably, upstream of valve 7 there is a filter 9, and inside freezer 1 there are two temperature probes 10 and 11 respectively arranged in lower compartment 2 and in upper compartment 3 for the reasons explained below.

[0015] Advantageously, temperature probe 10 is the main probe and controls the thermoregulation of freezer 1 in any operating conditions, whereas temperature probe 11 is an auxiliary probe which only controls the refrigerating circuit in a certain operating condition of freezer 1.

[0016] In addition to probe 10, the other components of the refrigerating circuit are also incorporated into freezer 1; in the drawing they appear as external components for clarity only.

[0017] Unlike the typical expansion valves commonly used in refrigerating systems, valve 7 is connected to evaporator 8 through two branches 12, 13 of the system: the first one connects the valve to the evaporator inlet, whereas the second one connects the valve to lower half 8a of the evaporator.

[0018] Thus the refrigerating fluid supplied by compressor 5 can flow through entire evaporator 8 or just through its second half 8a; advantageously, the latter is associated with lower compartment 2 of the freezer.

[0019] It follows that it is possible to refrigerate only the lower compartment of the freezer by sending the fluid supplied by compressor 5 to portion 8a of the freezer evaporator.

[0020] This allows to optimize the energetic efficiency of the freezer, since when the load (foodstuffs or the like) is small it can be placed entirely into the lower compartment and refrigerated by circulating the fluid within portion 8a of the evaporator.

[0021] It is apparent that this solution eliminates any thermal dispersion commonly found in prior-art freezers due to the empty spaces created when the load is much smaller than the available inner volume of the freezer.

[0022] When freezer 1 operates in a condition wherein the refrigerating fluid flows only through second portion 8a of the evaporator, main temperature probe 10 ensures, by activating compressor 5, that the foodstuffs contained in lower compartment 2 are preserved at the temperature set by the user, while auxiliary temperature probe 11 ensures, by activating compressor 5, that the temperature in upper compartment 3 remains below 0°C, so that any ice formed on evaporator 8 will not thaw. To

this end, it is possible to provide two control modes for solenoid valve 7 in order to circulate the refrigerating fluid within the whole evaporator or just a portion thereof.

[0023] A possible solution utilizes a simple manual control consisting of a push-button P, through which the user can turn on/off the function for cooling lower compartment 2 only.

[0024] Therefore, when the user fills up the freezer with newly purchased foodstuffs, he/she will turn said function off in order to let the refrigerating fluid circulate through the entire evaporator 8, thus cooling both compartments 2 and 3.

[0025] In this operating condition, the freezer operates normally and its regulation is done by starting and stopping compressor 5 in a controlled manner according to the temperatures detected by both probes 10 and 11.

[0026] As the quantity of foodstuffs decreases and the remaining contents of the freezer can be placed in lower compartment 2, the user will press push-button P to activate solenoid valve 7, so that the latter sends the fluid into branch 13 of the system and into second portion 8a of evaporator 8, located within lower compartment 2. Push-button P may be associated with a signaling device (e.g. a LED) adapted to inform the user about the operating mode of freezer 1. The thermoregulation of lower compartment 2 alone may be carried out, once push-button P has been pressed, through the very same device (e.g. a knob) adapted to adjust the working temperature of freezer 1 when operating at full load. The solution wherein valve 7 is controlled manually is undoubtedly the simplest one, but of course more complex alternatives may be taken into account, such as solutions wherein the valve is controlled by the control system of the freezer.

[0027] For example, sensors may be installed in freezer compartments 2 and 3 for signaling the degree of filling of said compartments, so that the control system of the freezer can control the refrigerating fluid flow by means of solenoid valve 7 in accordance with the above explanation.

[0028] Said sensors may be optical sensors or even load cells detecting the weight of the foodstuffs contained in compartments 2 and 3; as a function of these detections, the control system may let the refrigerating fluid flow through entire evaporator 8 or just a portion thereof.

[0029] Of course, the invention may be subject to several other variations with respect to the description provided so far.

[0030] For example, the configuration of evaporator 8 may be different according to the specific case; therefore, it may be provided by means of a coil integrated in the back wall of the freezer or in the shelves used for laying the foodstuffs to be frozen.

[0031] It is then clear that the principle of the invention is also applicable to freezers having more than two compartments 2 and 3; in these cases, evaporator 8 will have as many portions as the number of compartments in the freezer, and solenoid valve 7 will be connected thereto in such a manner as to let the refrigerating fluid circulate within one or more portions of the evaporator for cooling the associated compartments.

[0032] Furthermore, even though the invention is more suitable for static upright freezers, its application to ventilated freezers, such as the so-called "no-frost" freezers, or to horizontal freezers should not be excluded either; in such circumstances, variations may be provided with respect to the illustrated example.

[0033] Thus, by way of example, "no-frost" freezers may comprise air passages between compartments 2 and 3.

[0034] All of these variants will still fall within the scope of the following claims.

Claims

1. Freezer appliance comprising:

   at least two compartments (2, 3) for placing foodstuffs;
   a system for cooling said compartments (2, 3), which comprises a compressor (5) for compressing a refrigerating fluid circulating within the system, a condenser (6), a valve (7) for expanding the fluid, and an evaporator (8);

   characterized by comprising means (7, 12, 13) for conveying the refrigerating fluid towards the evaporator (8) or towards a portion (8a) thereof, which exchanges heat with one of said compartments (2).

2. Appliance according to claim 1, wherein the means for conveying the refrigerating fluid comprise a first and a second branch (12, 13) of the system, which branches respectively connect the valve (7) to the inlet of the evaporator (8) and to an intermediate point of the evaporator (8).

3. Appliance according to claim 2, wherein the valve (7) is adapted to convey the refrigerating fluid towards either one of said branches (12, 13) of the system.

4. Appliance according to claim 2 or 3, wherein the compartments (12, 13) are separated by a partition wall (4), and the portion (8a) of the evaporator (8) located downstream of the intermediate point connected to the second branch (13) of the system exchanges heat with one of said compartments (2).

5. Appliance according to claim 4, which is an upright type freezer.

6. Appliance according to claim 5, wherein the partition wall (4) is arranged transversally and is removable.

7. Appliance according to any of the preceding claims,

wherein the flow of refrigerating fluid either towards the evaporator (8) or towards a portion (8a) thereof is selected by a user through a push-button (P) or another similar control.

8. Appliance according to any of the preceding claims, comprising a pair of temperature probes (10, 11) respectively arranged in the compartments (2, 3) of the freezer, wherein the probe (10) arranged in the compartment (2), which exchanges heat with the portion (8a) of the evaporator (8) whereto the refrigerating fluid is conveyed, is used as a main probe for regulating the operation of the freezer appliance.

9. Freezer appliance according to any of the preceding claims, which is a static type freezer.

10. Appliance according to any of claims 1 to 8, which is a ventilated type freezer in which air circulation passages are provided between the two compartments (2, 3).

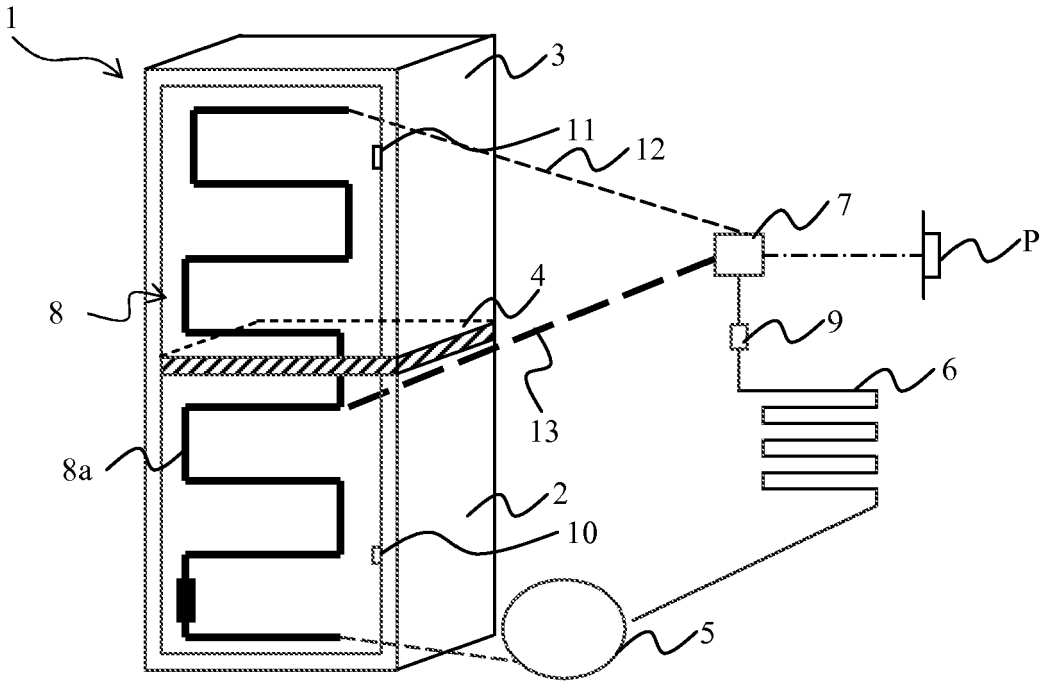

Fig. 1