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(72) Inventors:
• **SABATINI, Giorgio**
60044 Fabriano (AN) (IT)
• **CORBO, Luca**
81044 Tora e Picilli (CE) (IT)

(74) Representative: **Santonicola, Paolo**
Indesit Company S.p.A.
Viale Aristide Merloni 47
60044 Fabriano (AN) (IT)

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

(54) **REFRIGERATION DEVICE**

(57) A household refrigeration appliance for refrigerating food products, comprising:
- a refrigerator compartment (2);
- a freezer compartment (3);
- a cooling means (4) in fluid communication with the freezer compartment (3) and with the refrigerator compartment (2);
- a flow reduction valve (5) which is responsible for cooling of the refrigerator compartment (2).

The flow reduction valve (5) can be manually activated by a user.

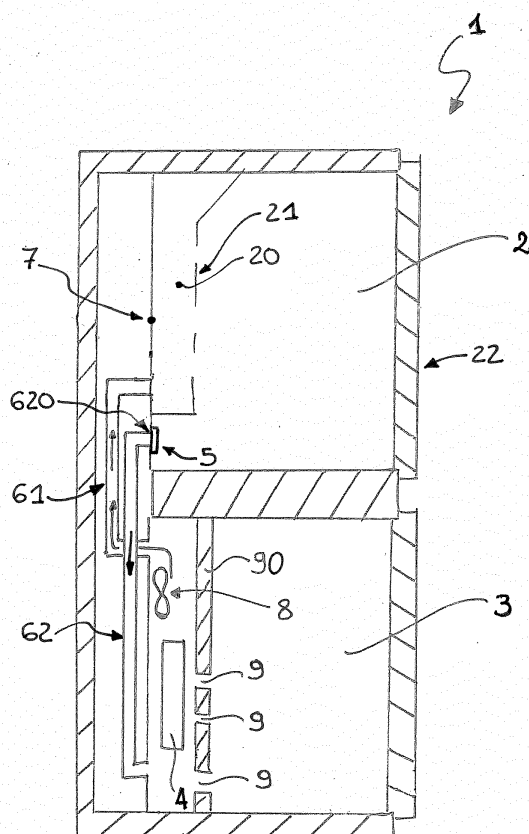


Fig. 1

Description

[0001] The present invention concerns a household appliance for food refrigeration, in particular a refrigerator-freezer. By refrigerator-freezer we mean a combined device featuring a refrigerator and a freezer compartment.

[0002] Refrigerator-freezers that include air cooling means are commonly available on the market. The cooled air is distributed to a freezer and a refrigerator.

[0003] To connect the cooling means, the refrigerator compartment features a delivery line and a return line.

[0004] An air-flow reduction valve may be installed along this delivery line (electrically controlled by its own motor and referred to in the industry as a "damper"), as well as a membrane hinged on one end that acts as a check valve.

[0005] To connect the cooling means to the freezer compartment, the rear wall of the freezer compartment usually features a set of passages. Normally there are no shut-off valves that allow to obstruct these passages.

[0006] The refrigerator and freezer compartments feature two temperature probes that ensure that additional cool air is supplied to the freezer compartment and even the refrigerator compartment, when necessary.

[0007] A drawback of this construction solution is tied to the presence (and thus the higher costs) of a damper, as well as two temperature probes, one for the refrigerator and one for the freezer compartment. Moreover, these components over time could get damaged, thus compromising proper operation of the refrigerator.

[0008] In this context, the technical objective underpinning the present invention is to provide a food refrigeration household appliance that requires a lower number of components. This allows a reduction of the costs of construction and even maintenance of the appliance.

[0009] The technical task and purposes specified herein are substantially met by a household appliance having structural and functional characteristics that are in accordance with the attached independent claims, additional embodiments being identified in the attached and corresponding dependent claims.

[0010] Further characteristics and advantages of the present invention will become more apparent from the following indicative, and hence non-limiting, description of a preferred, but not exclusive, embodiment of a household appliance as illustrated in the appended drawings, in which:

- Figure 1 shows a schematic view of a household appliance according to the present invention;
- Figure 2 shows a detailed view of a component of the household appliance according to the present invention;

[0011] In the accompanying drawings, reference number 1 indicates a household appliance for the refrigeration of food products. This household appliance 1 is

a refrigerator-freezer. It thus includes a refrigerator compartment 2. It also includes a freezer compartment 3.

[0012] Preferably, the temperature of refrigerator compartment 2 ranges between about 0°C and 10°C. Preferably, the temperature of freezer compartment 3 is roughly below -15°C.

[0013] In the configuration illustrated herein, refrigerator compartment 2 is positioned atop freezer compartment 3. In an alternative embodiment not illustrated herein and not preferred, refrigerator compartment 2 is positioned below freezer compartment 3. Compartments 2 and 3 are conveniently arranged one on top of the other.

[0014] The household appliance 1 is of a "no frost" type (which implies characteristics that are well-known in the technical field and therefore there is no need to provide additional explanations about this definition).

[0015] The household appliance 1 includes cooling means 4 in fluid communication with the freezer compartment 3 and with the refrigerator compartment 2.

[0016] These cooling means 4 can include a refrigerant circuit in which an operative fluid circulates which is used to cool down the air addressed to the refrigerator compartment 2 and freezer compartment 3. The refrigerant circuit may include an evaporator (which subtracts heat from the air to be sent to refrigerator compartment 2 and freezer compartment 3), a capacitor (which exchanges the heat subtracted from the evaporator air with the external environment), a throttling element and a compressor driven by an electric motor.

[0017] The household appliance 1 includes a flow (flow rate) reduction valve 5 for an air flow flowing between the refrigerator compartment 2 and the cooling means 4, for regulating the cooling of the refrigerator compartment 2.

[0018] The flow reduction valve 5 can be manually activated by a user. This operation is conveniently carried out from inside refrigerator compartment 2. The reduction valve 5 is thus accessible from inside refrigerator compartment 2.

[0019] In particular, valve 5 can be mechanically operated directly by the user. The operation of this valve 5 conveniently does not require the aid of tools such as wrenches, screwdrivers, etc.

[0020] The household appliance 1 includes a conduit 61 for conveying the refrigerated air coming from the cooling means 4 and directed to the refrigerator compartment 2. The conveying conduit 61 usually branches out in a gap 20 that develops between the top and bottom of the refrigerator compartment 2, and allows distribution of the cooled air at different heights within compartment 2. This gap 20 is usually featured in the rear wall 21 of the refrigerator compartment 2. Rear wall 21 is opposite to a hatch door 22 of compartment 2, when the hatch door is shut.

[0021] The household appliance 1 also includes a return conduit 62 for the air coming from the refrigerator compartment 2 and directed to the cooling means 4. This conduit 62 conveniently develops from the refrigerator

compartment 2.

[0022] Preferably, flow reduction valve 5 is associated to said air return conduit 62. In particular, valve 5 is installed at an inlet mouth 620 of return conduit 62. In this way, it is easily accessible by the user. Conveniently, the mouth 620 of return conduit 62 is directly accessible from refrigerator compartment 2 (and is not hidden behind wall cavities or elements that prevent access to it). Although associated to return conduit 62, it nonetheless reduces flow of the air that is responsible for cooling compartment 2. In fact, a reduction of valve 5 increases the load losses along a circuit that connects cooling means 4 and compartment 2, and therefore reduces the air flow rate in the circuit (the circuit includes the two conduits 61 and 62). This results in a reduction of the flow rate along conduit 61 conveying refrigerated air from cooling means 4 and directed towards refrigerator compartment 2, and therefore a lower cooling of refrigerator compartment 2.

[0023] This will benefit the cooling process inside freezer compartment 3, where the cooling action of cooling means 4 will concentrate..

[0024] Conveniently, shut-off valves to control air flowing in conduit 61 are absent.

[0025] A preferred construction solution for the reduction valve 5 is illustrated in Figure 2. It includes a plurality of openings 54. Reduction valve 5 includes a mobile shutter (hidden in Figure 2), which can clog part of these openings 54. In the preferred solution, the mobile shutter is integrally movable with a handle 510 accessible by the user from refrigerator compartment 2. This handle 510 is mobile in a loop 511 and a movement of handle 510 inside loop 511 corresponds to a movement of the shutter (and therefore a variation of the degree of reduction operated by valve 5). However, even in a configuration of maximum reduction of the air flow, said valve 5 is still crossed by air. In the solution shown in Figure 2, opening 54 on the right side of handle 510 cannot be obstructed by the shutter, which instead can obstruct the three openings 54 on the left side of handle 510.

[0026] The mobile shutter includes an element that slides cross-wise in direction of the air inlet on the air return conduit 62.

[0027] Reduction valve 5 included a fixed grille 53. Grille 53 defines the openings 54 described above, framing them. In a fully open configuration, the sliding element at least partially overlaps part of grille 53 that contributes to framing openings 54 (i.e. it overlaps on at least part of the fixed elements of the grille that obstruct the passage).

[0028] The household appliance 1 includes a temperature probe 7 that is sensitive to the temperature of refrigerator compartment 2 and that controls cooling means 4, and/or a fan 8 that circulates the cooled air from cooling means 4. Temperature probe 7 is installed near or at any rate close to refrigerator compartment 2. When this probe 7 detects an increase in the temperature above the pre-

[0029] A greater reduction of the reduction valve 5 determining a lower flow rate of refrigerated air to the re-

frigerator compartment 2 and thus greater cooling of the freezer compartment 3.

[0030] The activation of cooling means 4 and/or of said fan 8 is substantially insensitive to the temperature of the freezer compartment 3. No temperature probes activated by cooling means 4 and/or fan 8 are installed inside freezer compartment 3.

[0031] In the preferred solution, cooling means 4 are installed on the back of freezer compartment 3. One or more passages 9 on rear wall 90 of freezer compartment 3 allow fluid communication between the cooling means 4 and the freezer compartment 3. There are no air shut-off valves to control air flow through openings 9.

[0032] An example of how the invention works is provided below.

[0033] If a user wants to place food at room temperature in the freezer compartment, he will conveniently reduce the direct air flow into refrigerator compartment 2 by manually adjusting the reduction valve 5, favouring flow of direct air into freezer compartment 3.

[0034] In this way, the refrigerator-freezer can temporarily concentrate its action on freezer compartment 3. This minimises the risk that food at room temperature introduced in freezer compartment 3 can defrost other foods with which it comes into contact.

[0035] The present invention also provides important advantages.

[0036] First, it reduces the number of components of the refrigerator-freezer. This results in cost reduction, nonetheless allowing the user to adjust air flow distribution. Besides, less components and simplified electronics also make the machine more reliable.

[0037] The invention thus conceived is susceptible to numerous modifications and variants, all of which falling within the scope of the inventive concept characterizing the invention. Further, all the details can be replaced with other technically-equivalent elements. In practice, all the materials used, as well as the dimensions, can be any according to requirements.

Claims

1. A household refrigeration appliance for refrigerating food products, comprising:

- a refrigerator compartment (2);
- a freezer compartment (3);
- a cooling means (4) in fluid communication with the freezer compartment (3) and with the refrigerator compartment (2);
- a flow reduction valve (5) for an air flow flowing between the refrigerator compartment (2) and the cooling means (4), for regulating the cooling of the refrigerator compartment (2);

characterized in that said flow reduction valve (5) can be manually activated by a user.

2. The household appliance according to claim 1, **characterized in that** said valve (5) can be mechanically activated directly by the user.
3. The household appliance according to claim 1 or 2, **characterized in that** it comprises:
 - a conduit (61) for conveying the refrigerated air coming from the cooling means (4) and directed to the refrigerator compartment (2);
 - a return conduit (62) for the air coming from the refrigerator compartment (2) and directed to the cooling means (4);
 - said flow reduction valve (5) being located at an inlet mouthpiece (620) of said air return conduit (62).
4. The household appliance according to claim 1 or 2 or 3, **characterized in that** said flow reduction valve (5) comprises:
 - a plurality of openings (54);
 - a movable shutter that can occlude part of these openings (54); said valve (5) also enabling the air to pass through it in a configuration of maximum flow reduction.
5. The household appliance according to claim 4, **characterized in that** said movable shutter comprises an element that is slidable transversely to the direction of the air passing through the valve (5).
6. The household appliance according to claim 4 or 5, **characterized in that** said flow reduction valve (5) comprises a fixed grid (53) that defines said openings (54) by framing them; in a configuration of maximum aperture, the slidable element at least partly overlies a portion of the grid (53), which contributes to framing the openings (54).
7. The household appliance according to any one of the preceding claims, **characterized in that** it comprises a temperature probe (7) that is sensitive to the temperature of the refrigerator compartment (2), said probe (7) controlling the cooling means (4) and/or a fan (8) for moving the air cooled by the cooling means (4); greater flow reduction of the flow reduction valve (5) determining a lower flow rate of refrigerated air to the refrigerator compartment (2) and thus greater cooling of the freezer compartment (3).
8. The household appliance according to claim 7, **characterized in that** the activation of the cooling means (4) and/or of said fan (8) is substantially insensitive to the temperature of the freezer compartment (3).
9. The household appliance according to any one of

the preceding claims, **characterized in that** said cooling means (4) is found behind the freezer compartment (3), one or more passages (9) permitting fluid communication between said cooling means (4) and said freezer compartment (3); said refrigerator compartment (2) overlying the freezer compartment (3).

10. The household refrigeration appliance for refrigerating food products, comprising:
 - a refrigerator compartment (2);
 - a freezer compartment (3);
 - a cooling means (4) in fluid communication with the freezer compartment (3) and with the refrigerator compartment (2);
 - a flow reduction valve (5) for an air flow flowing between the refrigerator compartment (2) and the cooling means (4), for regulating the cooling of the refrigerator compartment (2);
 - a conduit (61) for conveying the refrigerated air coming from the cooling means (4) and directed to the refrigerator compartment (2);
 - a return conduit (62) for the air coming from the refrigerator compartment (2) and directed to the cooling means (4);
 - a temperature probe (7) sensitive to the temperature of the refrigerator compartment (2) and that controls the activation of the cooling means (4) and/or a fan (8) for moving the air cooled by the cooling means (4); the activation of the cooling means (4) and/or of said fan (8) is substantially insensitive to the temperature of the freezer compartment (3). **characterized in that** said flow reduction valve (5):
 - can be manually and mechanically activated directly by the user;
 - is located at an inlet mouthpiece (620) of said air return conduit (62). greater flow reduction of the flow reduction valve (5) determining a lower flow rate of refrigerated air to the refrigerator compartment (2) through the conveying conduit (61) and thus greater cooling of the freezer compartment (3).

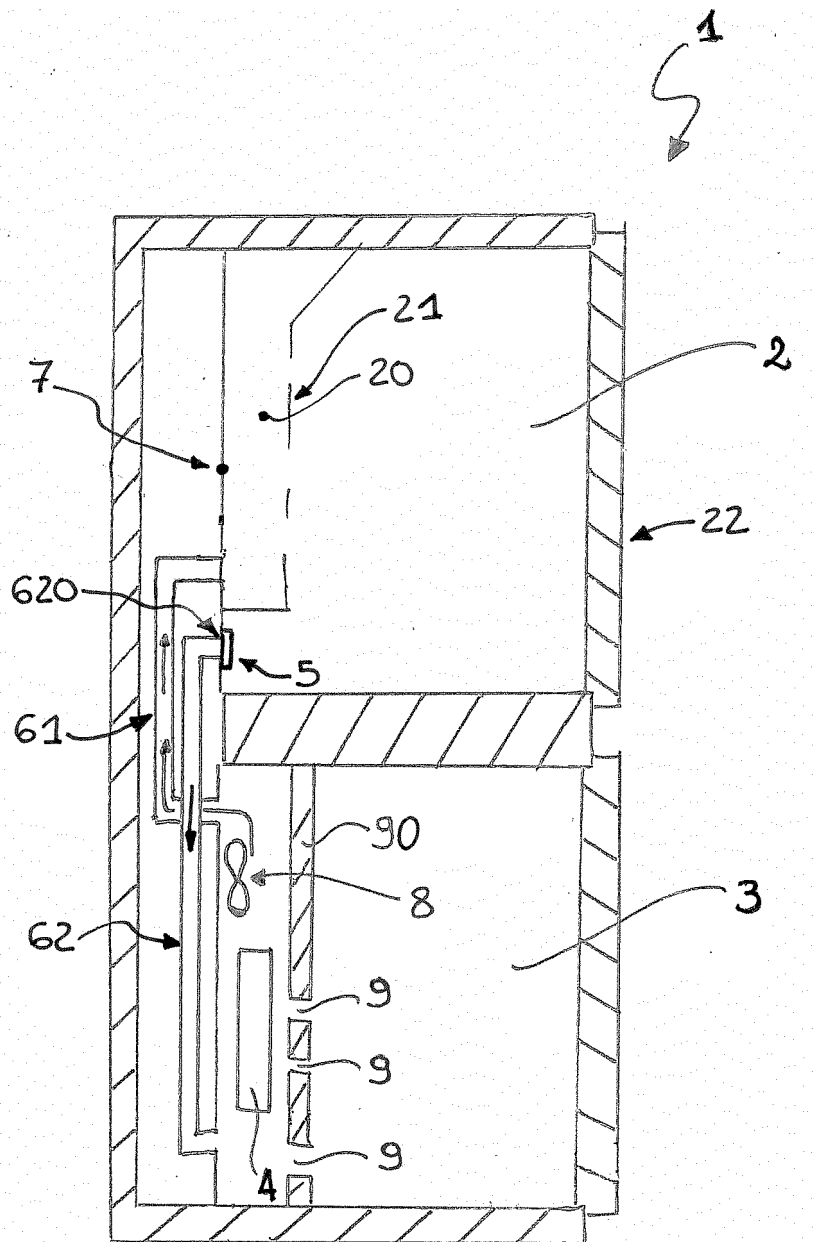
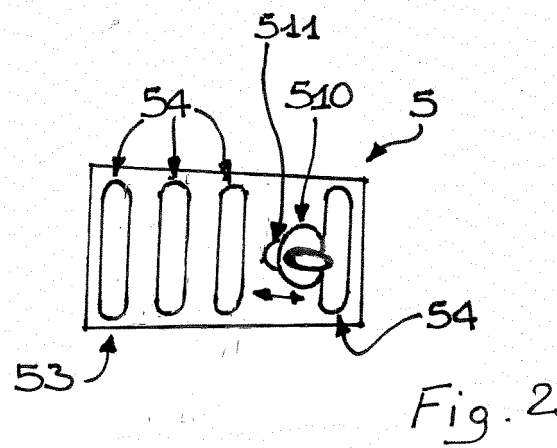


Fig. 1





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Application Number
EP 15 20 1255

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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document				

**ANNEX TO THE EUROPEAN SEARCH REPORT
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