



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.12.2001 Bulletin 2001/50

(51) Int Cl.7: **F25D 17/06**

(21) Application number: **01113056.4**

(22) Date of filing: **29.05.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **08.06.2000 IT MI001275**

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(54) **Refrigerator**

(57) A refrigerator comprises a compartment for preserving foods at a controlled temperature and positioned within a refrigerator cabinet which also comprises a compartment of temperature less than 0°C. The refrigerator comprises an interspace (K) defined by a wall (1a) of the refrigeration compartment (1), and at least one air conduit to connect the compartment (H) of temperature less than 0°C to the interspace (K) in order to cool the refrigeration compartment for preserving foods at a controlled temperature.

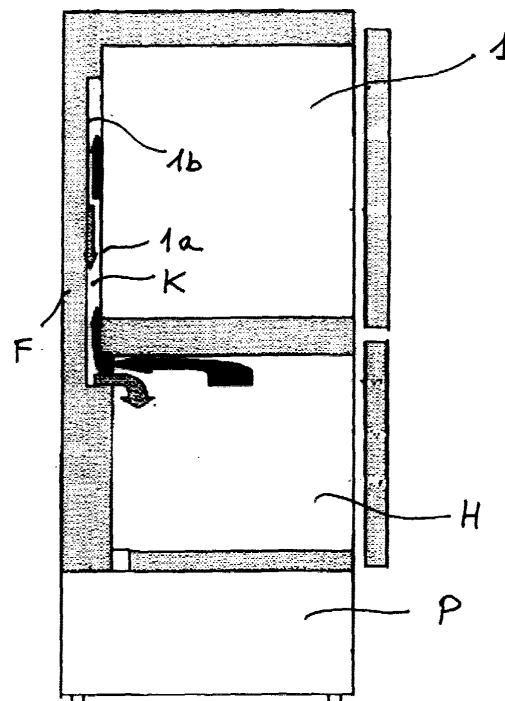


FIG. 2

Description

[0001] The present invention relates to a refrigerator in accordance with the introduction to the main claim.

[0002] Refrigerators are known comprising usually two compartments for preserving foods at different temperatures: a first compartment (or freezer compartment) is arranged to preserve foods at a temperature less than 0°C, whereas the other compartment (refrigeration compartment) is arranged to contain foods at a temperature higher than 0°C. These compartments are provided within an insulated refrigerator cabinet and are provided with independent closure doors. Said compartments are cooled by evaporators placed inside the compartments or in heat-exchange relationship with one or more walls of the compartment. This arrangement needs a long refrigeration circuit, with pipes going from the condenser to the evaporator and from this latter to the compressor, therefore increasing the overall cost of the appliance.

[0003] Various devices are also known for dividing the refrigeration compartment into compartments of smaller capacity and for closing them in order to create temperature conditions in them that differ from those of the remainder of the refrigeration compartment. These arrangements do not however enable the temperature within each small-capacity compartment to be modified at will in order to set it at values substantially lower or at values substantially higher than those of the refrigeration compartment.

[0004] An object of the present invention is therefore to provide a refrigerator in which the overall dimension of the refrigeration circuit is reduced if compared with conventional static refrigerators, and in which the designer can change easily dimension and shape of the compartments/cells without the need of redesigning the refrigeration circuit.

[0005] Another object of the present invention is to provide a refrigerator having an auxiliary compartment whose temperature is controlled but can be modified at will.

[0006] Another object is to provide a refrigerator enabling the creation of a compartment of controlled temperature that can be removed to re-obtain a refrigeration compartment that is not divided.

[0007] A further object is to provide a refrigerator of the stated type that is of simple and reliable use.

[0008] These and further objects which will be apparent to the expert of the art are attained by a device in accordance with the accompanying claims.

[0009] The present invention will be more apparent from the accompanying drawing, which is provided by way of non-limiting example and in which:

Figure 1 is a schematic section view of a refrigerator according to the invention;

Figure 2 is a schematic section view of a second embodiment of the invention;

Figure 3 is an enlarged view of a detail of Figure 1; Figure 4 is an exploded perspective view of a refrigerator compartment according to a third embodiment of the invention;

Figure 5 is an exploded perspective view from the rear of the refrigeration compartment of Figure 4;

Figure 6 is a front view of a part of the refrigerator of Figure 4; and

Figure 7 is a view from the rear of that part of the refrigerator of Figure 6.

[0010] With reference to said figures, a refrigeration compartment is indicated overall by 1, said compartment being arranged to preserve foods at a temperature exceeding 0°C.

[0011] According to Figure 1, the compartment 1 is mounted on a so-called refrigeration pack P in which a compressor, a condenser and an evaporator (not shown) are placed. These refrigeration packs are known in the art, but they are usually delivering cool and dry air directly in one or more compartments of a no-frost refrigerator. According to the present invention, the cool and dry air (indicated with black arrows in Figures 1-3) is delivered through an air duct and a fan (not shown) to an interspace K defined by a wall 1a of said compartment 1 and by an auxiliary outside wall 1b placed beside said wall 1a. The insulation material F can define the auxiliary outside wall 1b or it can be a plastic plate similar to the one used for the compartment wall. The inside of the interspace K is divided in two portions by a baffle B (Figure 3) so that the heat exchange between the cool air and the compartment is carried out in a more efficient way. From the interspace K, the air (which is indicated by grey arrows in Figures 1-3) is delivered back through an air duct (not shown) to the refrigeration pack P. It is clear that the conditions inside the compartment 1 are those of a static refrigerator, without the problem of food dryness typical of no-frost refrigerators. Moreover it is possible to design different refrigerators (with different compartments) by using a standardised refrigeration pack P.

[0012] In Figure 2 it is shown a second embodiment of the invention in which the cool air is delivered to the interspace K directly from a no-frost freezer compartment H placed under the refrigeration compartment 1. The freezer compartment H is cooled by cool air from the refrigeration pack P, as in a usual no-frost freezer.

[0013] In Figures 4-5 the refrigeration compartment 1 is shown as an independent structure, but is in fact inserted into a refrigerator cabinet (not shown) and is insulated on its sides in known manner.

[0014] The compartment 1 comprises a rear wall 2, sidewalls 3 provided with usual guides 4 for shelves 5 (only one being shown in Figure 4), an upper wall 6 and a lower wall 7. The walls 3, 6 and 7 bound an aperture 8 for access to the compartment 1, a door (not shown) being positioned on said aperture.

[0015] On the rear wall 2 there is provided a conden-

sate collection or drip channel 14 connected to a conduit 15 which leads the collected water to a collection member for this water located in a suitable position in the refrigerator (for example in a tray positioned below the usual compressor of the refrigerator refrigeration circuit). The rear wall 2 is provided with two through holes 16 for receiving terminal parts of channels or conduits 18 connecting the compartment 1 to a preservation compartment at a temperature less than 0°C (freezer compartment, not shown).

[0016] Finally, in a sidewall 3 there is provided a hole 17 removably closed by a closure element or plug 20.

[0017] According to an embodiment of the invention there is provided a device 21 for defining within the compartment 1 a preservation compartment at a controlled but modifiable temperature, for example lower or higher than the temperature of the compartment 1. This device 21 comprises a tray-shaped element 23, to be disposed on and parallel to, but spaced from, the rear wall 2 of the compartment 1 in a position corresponding with the holes 16, such as to define an interspace with said end wall. The element 23 acts as the rear wall of the compartment of controlled temperature.

[0018] This element comprises a body 24 presenting a face 25 on which a condensate collection or drip channel 26 is provided, this presenting an aperture 27 connected to a channel 28 inserted into a seat 29 provided in the wall 2 and connected in known manner to the said condensate water collection member. The body 24 presents a face 30 opposite the face 25 and bounded laterally by a raised peripheral edge 31 for supporting a seal member or gasket (not shown) which cooperates, by resting thereagainst, with the wall 2 of the compartment 1. The face 30 and the edge 31 define a cavity 33 containing a heater element 34, for example an electrical resistance element fixed to an aluminium sheet secured (for example glued) to the face 30 and connected to an electrical connector 36 arranged to cooperate with a socket member 37 fixed to the compartment 1 and electrically powered. Supports 39 project into the cavity 33 from the face 30 to carry a fan 40 which is electrically powered (in known manner, via the connector 36). The fan is preferably of tangential type and is positioned at one of the holes 16 provided in the wall 2, so that it forcibly draws cold air from the corresponding channel 18 when a compartment of controlled temperature less than 0°C is required, the other of the two channels 18 returning the air to the freezer compartment. The element (or wall) 23 is arranged to be fixed to the wall 2 by screws (not shown) inserted into seats 41 provided in said element, and into seats 42 provided in the wall 2.

[0019] The compartment of controlled temperature can be separated from the remaining part of the compartment 2 by a separator 43 presenting a portion 44 able to slide on the guides 4 of the walls 3 and a portion 45 perpendicular to the portion 44; the portion 45 defines a frame for the sliding of a drawer 46 presenting a main portion 47 provided with a lower grid 48 on which a sep-

arator panel 49 is present, and a closure element 50 (or front element of the drawer 46).

[0020] With the separator panel 43 there is also associated a user interface 51 provided with control members for the fan 40 and heater 34. This interface also comprises the means (for example a microprocessor unit) for controlling said fan and heater on the basis, for example, of a temperature set by the user and of data measured by a temperature sensor (known per se and not shown) disposed in the hole 17 opening into the compartment of controlled temperature.

[0021] It will now be assumed that the device 21 is to be used mounted in the refrigeration compartment 1.

[0022] If a compartment of controlled temperature less than that of the compartment 1 is to be obtained, the fan 40 is activated to draw cold air from the compartment of temperature less than 0°C. This activation can be achieved by simply operating a pushbutton present on the interface 51, after which the control unit will halt the fan when the temperature measured by the sensor positioned in the compartment under consideration has reached a predetermined value.

[0023] In contrast, if a temperature higher than that of the refrigeration compartment 1 is to be obtained in the controlled-temperature compartment, the heater element 34 is activated. This is achieved by operating a pushbutton, as a result of which the element 34 is controlled by the control unit in conjunction with the temperature sensor positioned in that compartment.

[0024] Alternatively, the interface 51 can comprise means for setting the temperature within the controlled-temperature compartment, which means can be an actual temperature selector (selection by the user, within a limited range, for example from -2°C to +14°C) or a series of pushbuttons corresponding to particular foods (for example, meat and fish or fruit and vegetables) with which there correspond particular (set) temperature conditions to be attained and maintained in the compartment of controlled temperature by activating the fan 40 or the element 34. This is effected under the control of the control unit connected to said pushbuttons.

[0025] By virtue of the invention an additional compartment can be obtained within the refrigeration compartment, said additional compartment having temperature conditions which can be considerably different from those of the refrigeration compartment. The purpose of this is to suitably preserve products (food or non-food) requiring particular conditions which cannot be suitably achieved within the refrigeration compartment.

[0026] The device of the invention can also not be provided with the fan. In this case the air circulation through the interspace defined by the element 23 is achieved by natural convection. Moreover, valve means can be provided at the holes 16 to ensure improved isolation of the interspace within the freezer compartment when the device is not in use.

Claims

1. A refrigerator comprising a refrigeration circuit including an evaporator, and a compartment for preserving foods at a controlled temperature, **characterised in that** it further comprises channel means (18) for delivering air cooled by means of the evaporator (P) to an interspace (K) delimited by a wall (1a, 25) of said compartment (1), such interspace (K) being in heat-exchange relationship with the compartment (1). 5
2. A refrigerator according to claim 1, which comprises also a compartment (H) at temperature less than 0°C, **characterised in that** said channel means comprise ducts (18) for delivering cool air from the compartment at temperature less than 0°C to the interspace (K) and for returning cool air from said interspace (K) to the compartment at temperature less than 0°C. 10
3. A refrigerator according to claim 2, **characterised in that** said channel means (18) comprise a first duct for delivering cool air to a first portion of the interspace (K) in direct heat-exchange relationship with the wall (1a) of the compartment (1), and a second duct for returning cool air from a second portion of the interspace (K) in direct heat-exchange relationship with said first portion of the interspace, said first and second portion of the interspace (K) being substantially divided by a baffle (B). 15
4. A refrigerator according to claim 2 or 3, **characterised in that** it further comprises a refrigeration pack (P) including compressor, condenser and evaporator and adapted to deliver cool air to the compartment at temperature less than 0°C. 20
5. A refrigerator according to claim 1, in which the evaporator is placed in a refrigerator pack (P) outside the compartment (1), and including compressor, condenser and evaporator, **characterised in that** said channel means comprise ducts for delivering and returning cool air from and to the refrigeration pack (P) to and from the interspace (K) respectively. 25
6. A refrigerator according to claim 5, **characterised in that** said channel means comprise a first duct for delivering cool air to a first portion of the interspace (K) in direct heat-exchange relationship with the wall (1a) of the compartment (1), and a second duct for returning cool air from a second portion of the interspace (K) in direct heat-exchange relationship with said first portion of the interspace, said first and second portion of the interspace (K) being substantially divided by a baffle (B). 30
7. A refrigerator according to claim 1, comprising an auxiliary compartment for preserving foods at a controlled temperature within a refrigeration compartment (1), this latter being positioned within a refrigerator cabinet which also comprises a compartment of temperature less than 0°C, **characterised by** comprising a first element (23) to be disposed in the manner of an interspace to the front of but spaced from a wall (2) of the refrigeration compartment (1), at least one air conduit (18) to connect the compartment of temperature less than 0°C to the interspace defined by the first element (23) and by the wall (2) of the refrigeration compartment (1), and at least one flat second element (44) bounding that portion of the refrigeration compartment (1) in which said first element (23) is present so as to create said auxiliary compartment within said refrigeration compartment (1), means (20, 34, 40) at least partly associated with said first element (23) being provided to control and modify the temperature within the auxiliary compartment thus created. 35
8. A refrigerator as claimed in claim 7, **characterised in that** said first element (23) is associated with the rear wall (2) of the refrigeration compartment (1) and in which two air conduits (18) are used for circulating air between the interspace and the compartment of temperature less than 0°C. 40
9. A refrigerator as claimed in claim 8, **characterised in that** the first element (23) comprises, facing an access aperture (8) of the refrigeration compartment (1), a first side (25) provided with a drip channel (26), this latter presenting a through hole (27) opening into a second side (30) of said first element opposite said first side (25), where it is connected to a discharge channel (28), said second side (30) facing the rear wall (2) of the refrigeration compartment (1) and being surrounded peripherally by a raised edge (25) carrying a seal member arranged to rest on the rear wall (2) of said compartment (1), the second side (30) and the raised edge (25) bounding, in the first element (23), a cavity (33) containing at least the means (34, 40) for modifying the temperature of the compartment of controlled temperature. 45
10. A refrigerator as claimed in claim 7 or 9, **characterised in that** the temperature modifying means comprise a heater element (34) associated with the second side (30) of the first element (23), and a member (40) for drawing cold air from the compartment of temperature lower than 0°C and positioned in the cavity (33) of said first element (23). 50
11. A refrigerator as claimed in claim 10, **characterised in that** the heater element is an electrical resistance element and it is associated with a metal or metal- 55

lized sheet secured to the second side (30) of the first element (23).

12. A refrigerator as claimed in claim 10, **characterised in that** the member for drawing cold air is a fan (40) located in a position corresponding with an air duct (18). 5

13. A refrigerator as claimed in claim 7 or 10, **characterised in that** the temperature modifying means (34, 40) are electrically powered via an electrical connection member (36) associated with the first element (23) and arranged to cooperate with a counter-member associated with the rear wall (2) of the refrigeration compartment (1). 10
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14. A refrigerator as claimed in claim 7, **characterised in that** the temperature control means comprise a temperature sensor situated in a seat (17) provided in a wall (3) of the refrigeration compartment and positioned such that it lies in the interior of the compartment of controlled temperature, said sensor being connected to a unit for controlling the operation of the temperature modifying means (34, 40). 20
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15. A refrigerator as claimed in claims 7 and 14, **characterised in that** the control unit is associated with a user interface (51) carried by the second element (44). 30

16. A refrigerator as claimed in claim 15, **characterised in that** the second element (44) is supported by the side walls (3) of the compartment (1) and is connected to a portion (45) perpendicular to it and supporting the user interface (51), said perpendicular portion (51) defining a frame for the movement of a container or drawer (46) for the compartment of controlled but modifiable temperature. 35
40

17. A refrigerator as claimed in claim 15, **characterised in that** the second element (44) and the portion (45) perpendicularly associated with it are parts of an element (43) separating the compartment of controlled but modifiable temperature from the remaining volume of the refrigeration compartment (1). 45
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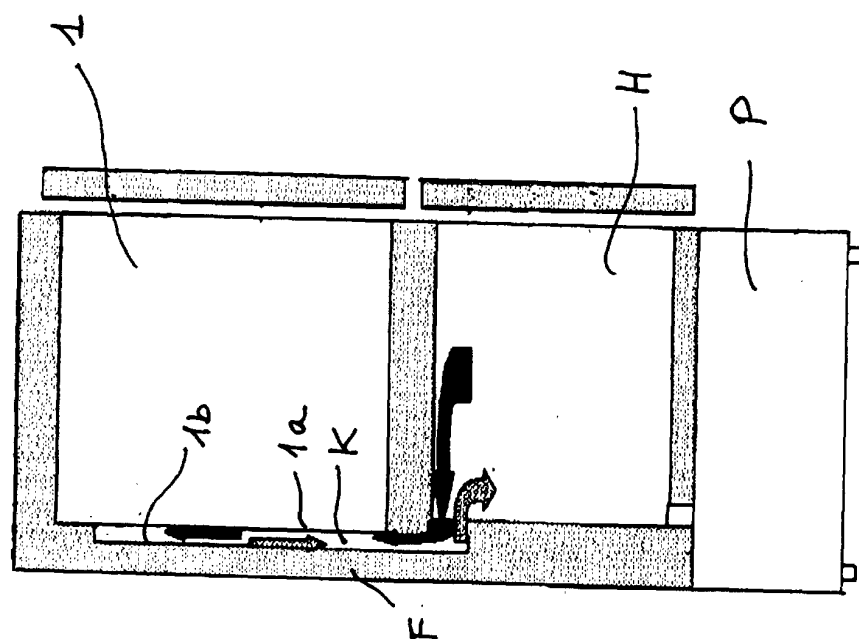


FIG. 2

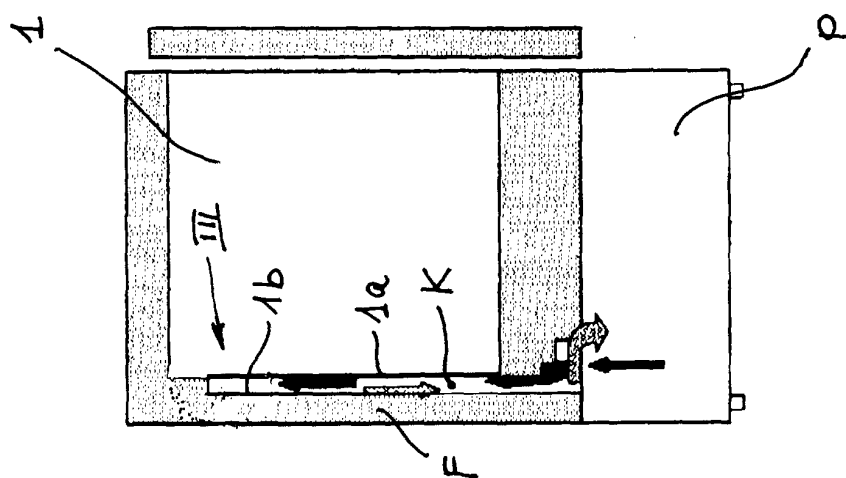


FIG. 1

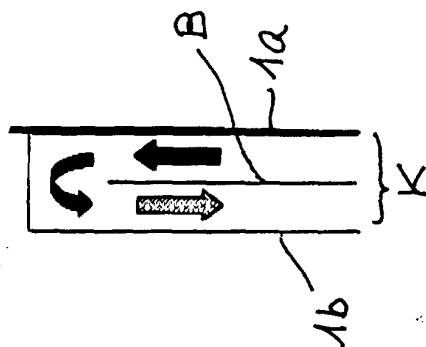


FIG. 3

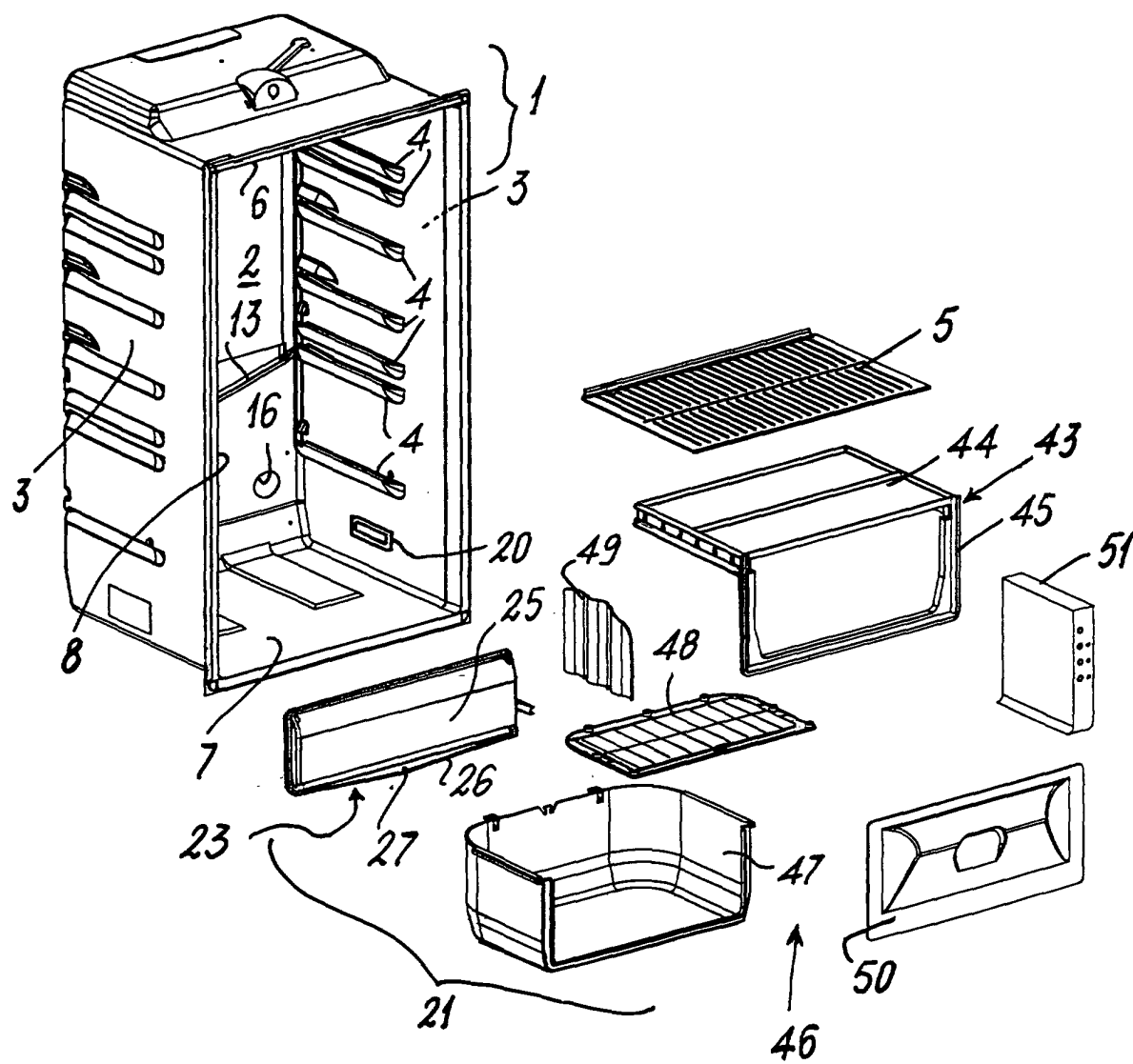


FIG. 4

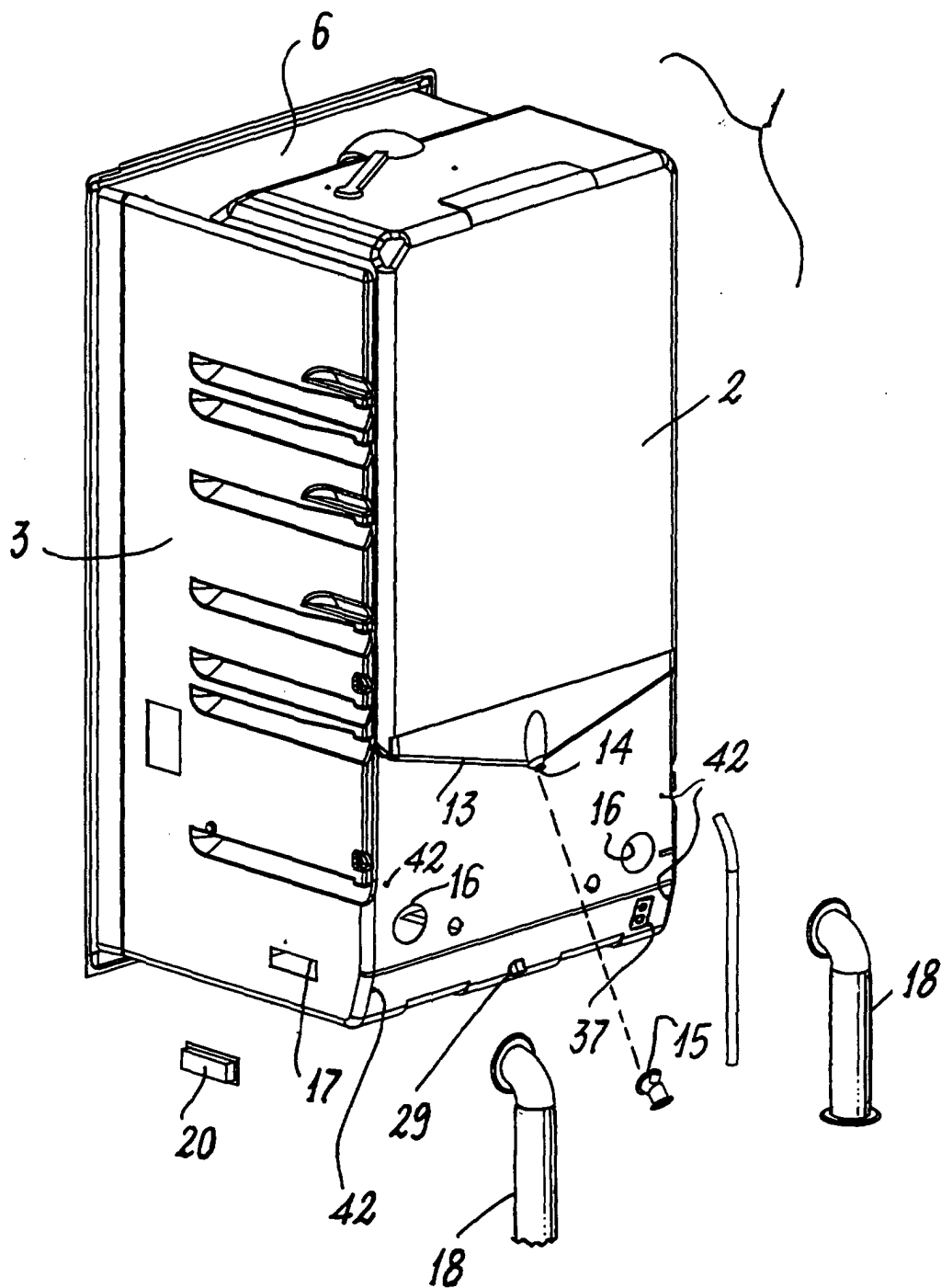


FIG. 5

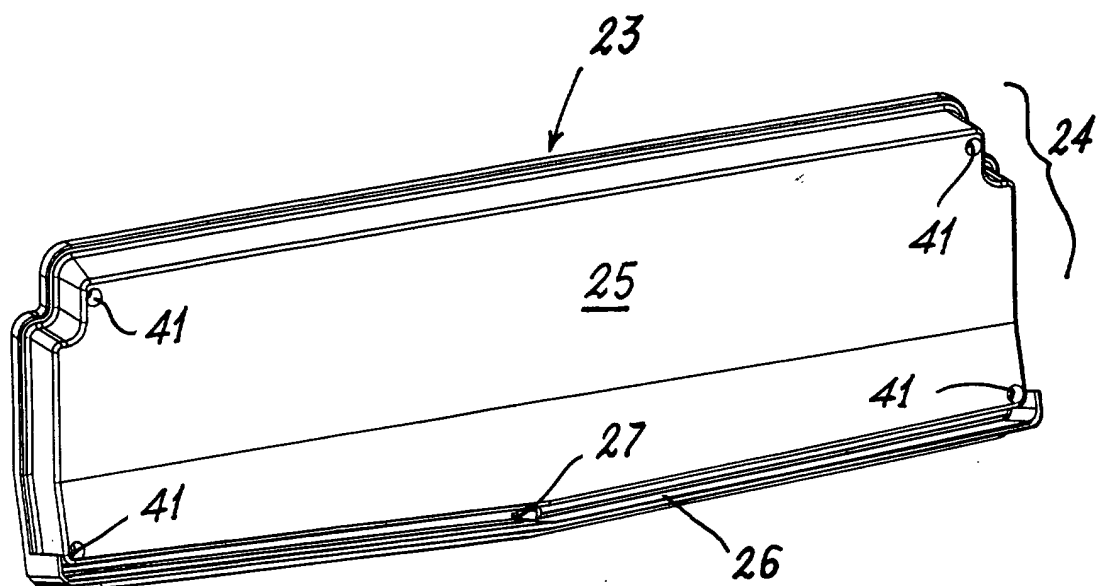


FIG. 6

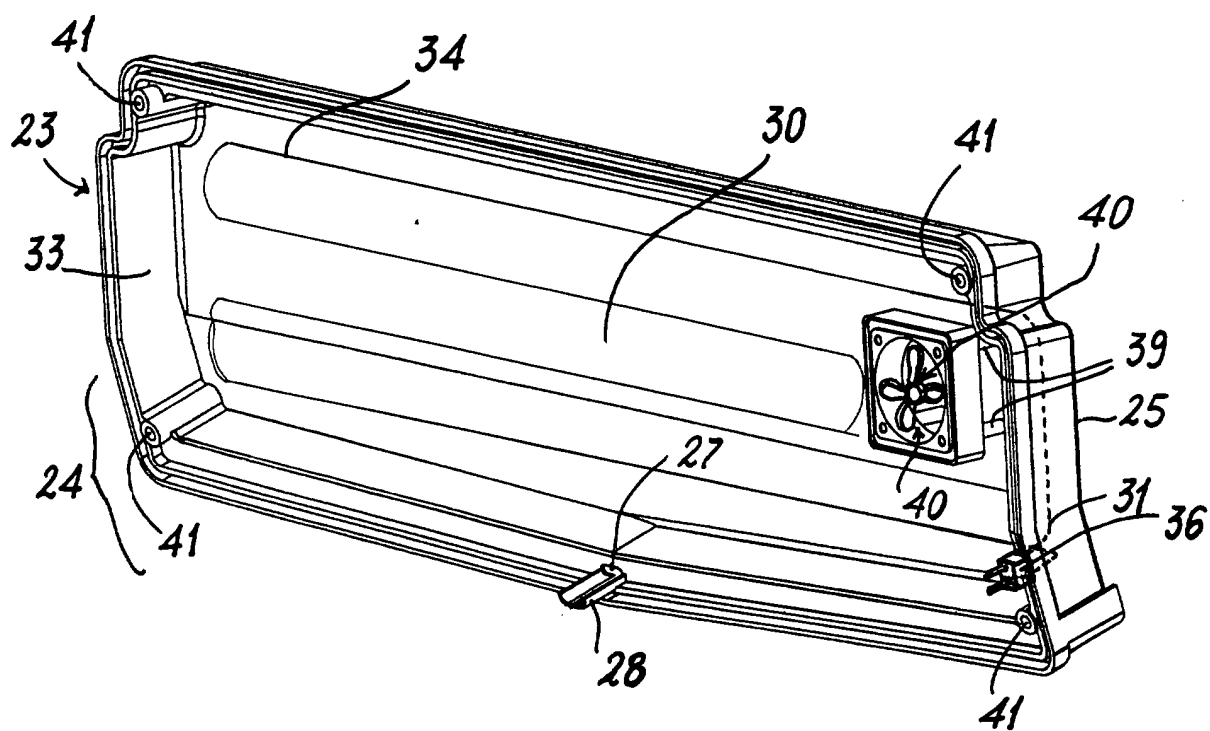


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
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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			

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