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(54) DEFROSTING A FREEZER CELL OF A REFRIGERATING APPLIANCE, AND RELATED REFRIGERATING APPLIANCE

(57) Defrosting device of the freezer cell of a refrigerating appliance, said refrigerating appliance comprising a refrigerator cell and a freezer cell (1), a refrigeration circuit comprising a freezer cell evaporator shaped as a coil (3) spiral-wound around the outer side surface (2) of said freezer cell, a refrigerating fluid flowing in said coil, said defrosting device comprising:

- a heating element, spiral-wound around said outer side surface (2) of the freezer cell, in the interspace between the windings of the evaporator coil (3);
- a defrosting activation circuit, adapted to activate said heating element (4) and deactivate the circulation of said refrigerating fluid in said evaporator coil (3) for a defrosting time.

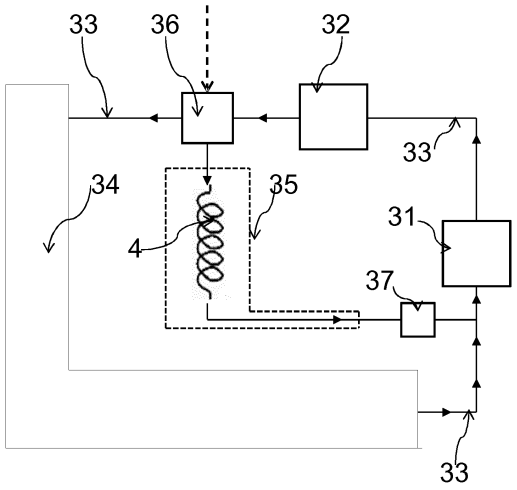

FIG. 4

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Description

[FIELD OF THE INVENTION]

[0001] The present invention relates to the field of household appliances, particularly to a method and a device for defrosting a freezer cell of a refrigerating appliance, as well as to a related refrigerating appliance.

[PRIOR ART]

[0002] Refrigerating appliances are known which comprise at least one refrigerated cell, a door allowing access to the refrigerated cell, and a refrigeration circuit implementing a refrigeration cycle.

[0003] Several types of refrigerating appliances are known. Among these, by way of non-limiting example, appliances can be identified which comprise at least one cooled cell having an internal temperature slightly above 0°C (e.g. 4-5 °C), hereafter referred to as refrigerator cell, which is normally used for preserving unfrozen fresh foods or objects, and at least one freezer cell kept at a freezing temperature below 0°C (e.g. - 18°C), which is normally used for preserving frozen foods or objects; each cell is normally fitted with an access door of its own.

[0004] During the operation of the refrigerating appliance, formation of frost or ice may occur on the inner walls of the cells, in particular on the coldest parts thereof, such as those near the evaporator of the refrigeration circuit, which is due to the moisture present inside the refrigerating appliance. The layer of frost or ice grows in operation, also leading to increased thermal insulation between the evaporator of the refrigeration circuit of the refrigerating appliance and the environment to be cooled, thus adversely affecting thermal exchange efficiency.

[0005] A type of refrigerating appliance is known wherein the evaporator of the freezer cell is shaped as a coil spiral-wound around the outer side surface of the cell, as described, for example, in EP-1831625-A.

[0006] No devices are known for automatic defrosting of such types of freezer cells; therefore, the defrosting operation is normally carried out by manually scraping the frost or ice off the inner walls of the cell by means of a tool.

[0007] Thus, the problem that needs to be addressed is to optimize the freezer cell defrosting operation by making it automatic and fast, thereby ensuring the utmost energetic efficiency and optimizing the energy consumption of the refrigerating appliance. A further problem that needs to be addressed it to prevent frozen foods or objects from unfreezing and deteriorating during this defrosting operation.

[OBJECTS AND SUMMARY OF THE INVENTION]

[0008] It is one object of the present invention to propose a method and a device for defrosting a freezer cell of a refrigerating appliance, as well as a related refrigerating appliance, which can solve the above-described problems.

[0009] The refrigerating appliance is equipped with a refrigerator cell and a freezer cell, each fitted with an access door of its own.

[0010] In particular, it is one object of the present invention to provide a method for controlling the step of defrosting the freezer cell of a refrigerating appliance so as to ensure the utmost energetic efficiency and optimize the energy consumption of the refrigerating appliance.

[0011] It is a further object of the present invention to provide a method and a device which allow to ensure a proper and reliable preservation of the contents of the refrigerating appliance.

[0012] The general idea at the basis of the present invention is to wind a heating element in a spiral fashion around the outer side surface of the freezer cell, in the interspace between the windings of the coil of the evaporator of the cell itself.

[0013] Advantageously, the heating element is provided as an electric cable or tube, or as a hot-fluid circulation duct.

[0014] The present invention relates to a defrosting device of a freezer cell of a refrigerating appliance, said refrigerating appliance comprising a refrigerator cell and a freezer cell, a refrigeration circuit comprising a freezer cell evaporator shaped as a coil spiral-wound around the outer side surface of said freezer cell, a refrigerating fluid flowing in said coil, said defrosting device comprising:

- a heating element, spiral-wound around said outer side surface of the freezer cell, in the interspace between said windings of the evaporator coil;
- a defrosting activation circuit, adapted to activate said heating element and deactivate the circulation of said refrigerating fluid in said evaporator coil for a defrosting time.

[0015] The present invention particularly relates to a method and a device for defrosting a freezer cell of a refrigerating appliance as specifically set out in the appended claims, which are an integral part of the present description.

Brief description of the drawings

[0016] Further objects and advantages of the present invention will become apparent from the following detailed description of an example of embodiment thereof and from the annexed drawings, which are only supplied by way of non-limiting example, wherein:

Figure 1 shows a perspective view of a freezer cell of a refrigerating appliance according to the invention;

Figure 2 shows a sectional side view of the freezer cell;

Figure 3 shows a partial sectional view of the freezer

cell and, in a magnification box, a part of the side surface thereof showing how elements that characterize the invention are arranged;

Figure 4 shows a block diagram of the refrigeration circuit, which comprises a variant embodiment of the heating element according to the invention.

[0017] In the drawings, the same reference numerals and letters identify the same items or components.

[DETAILED DESCRIPTION OF THE INVENTION]

[0018] With reference to the drawings, a freezer cell 1 of a refrigerating appliance is equipped with side walls 2, on the outer surface of which a coil 3 of the refrigeration circuit is wound, which is of the type known in the art, with windings occupying all or most of the side surface, the pitch between a plurality of windings being advantageously constant.

[0019] The door of the cell is not shown.

[0020] In accordance with the present invention, a heating element 4 is spiral-wound around the outer side surface 2 of the freezer cell, in the interspace between the windings of the coil 3 of the evaporator of the cell itself. Therefore, also the windings of the heating element 4 occupy all or most of the outer side surface of the cell, the pitch between a plurality of windings of the heating element 4 being advantageously constant.

[0021] Advantageously, the heating element is provided as an appropriately shielded electric cable or tube, e. g. of the distributed electric resistance type, or as a hot-fluid circulation duct.

[0022] The side surface 2 of the cell is normally made of a rigid plastic material.

[0023] Around it, on the outside, a layer 5 of heat-conducting material is preferably wound, such as, for example, an aluminium sheet, which is interposed between the windings 3, 4 and the outer surface 2 of the cell. This can improve and speed up the thermal exchange between the inside of the cell and, respectively, the coil 3 of the refrigeration circuit, during the cooling step, and the coil 4 of the heating element, during the defrosting step.

[0024] The distribution of the coil of the heating element 4 is preferably uniform over the side walls of the cell, and parallel to the distribution of the evaporator coil, with no overlapping.

[0025] In the case wherein the heating element 4 is shaped as an electric cable or tube, the coil preferably has a uniform circular cross-section throughout its length, though other cross-sections are also possible, e.g. a rectangular flat cable.

[0026] The material it is made of is a metallic one, preferably copper or aluminium, preferably with braided wires; since it must carry electric energy, it is coated with a layer of electrically insulating material.

[0027] The power supply to the electric cable or tube can be obtained through a normal connection to the mains power. Depending on the power supply voltage of the cable or tube, an electric voltage adapter circuit of a *per se* known type may be interposed.

[0028] In the case of a heating element 4 shaped as a hot-fluid circulation duct, in an example of embodiment described herein with reference to Figure 3 the fluid of the refrigeration circuit is made to flow in the duct by a controlled valve that diverts the circulation of the fluid of the refrigeration circuit, taking it downstream of the condenser and returning it upstream of the compressor of the circuit.

[0029] In particular, the refrigeration circuit comprises, in a *per se* known manner, a compressor 31, a condenser 32 downstream of the compressor with reference to the direction of circulation of the refrigerating fluid 33, a block 34 comprising expansion elements and evaporators not specifically highlighted in the drawing, in particular specific for the refrigerator cell and the freezer cell, which close the circulation of the fluid 33 of the refrigeration circuit from the condenser 32 to the inlet of the compressor 31. In particular, the evaporator of the freezer cell is shaped as a coil spiral-wound around the outer side surface of the freezer cell, as previously described.

[0030] The heating element 4 of the invention, in the form of a hot-fluid circulation duct, is schematically represented in the drawing within the dashed line 35. A suitably controlled valve 36 arranged downstream of the condenser 32, when activated in order to execute the defrosting function of the invention, can divert the flow of fluid exiting the condenser 32 into said heating element 4, thus stopping the circulation of the fluid in the elements of the block 34. The hot-fluid circulation duct feeds the fluid upstream of the compressor 31. A known cooling element 37 may be present for cooling the fluid exiting the defrosting branch before it enters the compressor.

[0031] A layer of foam is preferably applied over the cell, including the coils, which are coated beforehand with polyethylene tape.

[0032] The defrosting function control circuit may include a manually-operated switch, which activates the heating element 4, or turns on electric current circulation in the case of a heating element 4 shaped as an electric cable or tube, or switches the valve 36 in the case of a heating element 4 shaped as a hot-fluid circulation duct.

[0033] The defrosting step is carried out in a controlled manner. This control can be effected by imposing a predefined duration or a predefined temperature. Or, as an alternative, a manual deactivation may be effected by operating the switch again, e.g. at the end of a manual cell cleaning step.

[0034] The refrigerating appliance is equipped with a circuit for controlling the operation of the refrigeration circuit, which turns on/off the compressor and controls the circulation of the refrigerating fluid in both circuits, i.e. the refrigerator and freezer circuits, and the defrosting function of the present invention.

[0035] The method for controlling the defrosting step of the invention includes the following steps:

When the freezer cell defrosting function is turned on, an initial step is preferably activated for decreasing the temperature in the refrigerator cell, until a minimum temperature above zero is reached, e.g. 2°C. In this way, the refrigerator cell can be used for temporarily transferring into it the frozen foods or objects from the freezer cell, so that they will undergo no deterioration in the short time required for defrosting the freezer cell.
When said temperature has been reached in the refrigerator cell, the heating function of the heating element is activated and the circulation of refrigerating fluid in the coil of the evaporator of the freezer cell is stopped.

[0036] In this manner, the freezer cell will be defrosted quickly, thus ensuring the utmost energetic efficiency and contributing to optimizing the energy consumption of the refrigerating appliance.

[0037] At the end of the defrosting step, e.g. when said predefined duration has elapsed or said predefined temperature in the freezer cell has been reached, a signalling is preferably activated first to allow the user, for example, to clean the freezer cell.

[0038] Afterwards, upon a new manual activation of the defrosting function switch, the heating element is deactivated and the circulation of refrigerating fluid in the circuit of the freezer cell is restored: the refrigerating appliance will thus resume its normal operation.

[0039] The activation of the various steps may be signalled by means of an audible or visual signalling device, which is especially useful when such steps are activated manually.

[0040] The construction of the control device for implementing the above-described method will not be a problem for those skilled in the art.

[0041] The steps of the method can be carried out through a controller using known hardware and, possibly, known software.

[0042] The elements and features shown in the various preferred embodiments may be combined together without however departing from the protection scope of the present invention.

[0043] It is apparent that many changes may be made to the present invention by those skilled in the art without departing from the protection scope thereof as stated in the appended claims.

[0044] These embodiments will nonetheless still fall within the protection scope of the present invention.

Claims

1. Defrosting device of the freezer cell of a refrigerating appliance, said refrigerating appliance comprising a refrigerator cell and a freezer cell (1), a refrigeration circuit comprising a freezer cell evaporator shaped as a coil (3) spiral-wound around the outer side surface (2) of said freezer cell, a refrigerating fluid flowing in said coil, said defrosting device comprising:

   - a heating element, spiral-wound around said outer side surface (2) of the freezer cell, in the interspace between the windings of the evaporator coil (3);
   - a defrosting activation circuit, adapted to activate said heating element (4) and deactivate the circulation of said refrigerating fluid in said evaporator coil (3) for a defrosting time.

2. Defrosting device according to claim 1, wherein said windings of the heating element occupy all or most of said outer side surface of the cell.

3. Defrosting device according to claim 1, comprising a layer (5) of heat-conducting material between said coils of the evaporator and of the heating element and said outer surface (2) of the freezer cell.

4. Defrosting device according to claim 1, wherein the distribution of said spiral of the heating element is uniform over the side walls of the cell, and parallel to the distribution of the evaporator coil.

5. Defrosting device according to any one of the preceding claims, wherein said heating element is shaped as an electric heating cable or tube, or as a hot-fluid circulation duct.

6. Defrosting device according to claim 5, wherein said electric heating cable or tube has a uniform circular or rectangular cross-section throughout its length.

7. Defrosting device according to claim 5, wherein, in the case of a heating element shaped as an electric cable or tube, the power supply to said electric cable or tube is obtained through a connection to the mains power, and said defrosting activation circuit comprises an electric switch, possibly equipped with an electric voltage adapter circuit.

8. Defrosting device according to claim 5, comprising, in the case wherein the heating element is shaped as a hot-fluid circulation duct, a controlled valve adapted to divert the circulation of the fluid of said refrigeration circuit into said hot-fluid circulation duct within the duct itself, by taking it downstream of a condenser and returning it upstream of a compressor of said refrigeration circuit.

9. Defrosting device according to any one of the preceding claims, wherein said activation circuit comprises means for controlling said defrosting time, which are adapted to impose a preset duration or a preset temperature, or comprises a manual on/off switch.

10. Refrigerating appliance comprising a refrigerator cell and a freezer cell (1), a refrigeration circuit comprising a freezer cell evaporator shaped as a coil (3) spiral-wound around the outer side surface (2) of said freezer cell, a refrigerating fluid flowing in said coil, said refrigerating appliance comprising a defrosting device according to any one of the preceding claims.

11. Method for defrosting a freezer cell of a refrigerating appliance according to claim 10, comprising the following steps:

- activating said activation circuit, thereby stopping the circulation of fluid in the freezer cell evaporator;
- activating said heating element for said defrosting time;
- after said defrosting time has elapsed, deactivating the heating element and re-activating the fluid circulation.

12. Defrosting method according to claim 11, comprising, prior to said step of activating said activation circuit, an initial step of decreasing the temperature in the refrigerator cell to a minimum temperature above zero.

13. Defrosting method according to claim 11 or 12, comprising the activation of an audible or visual signaling for each one of said steps.

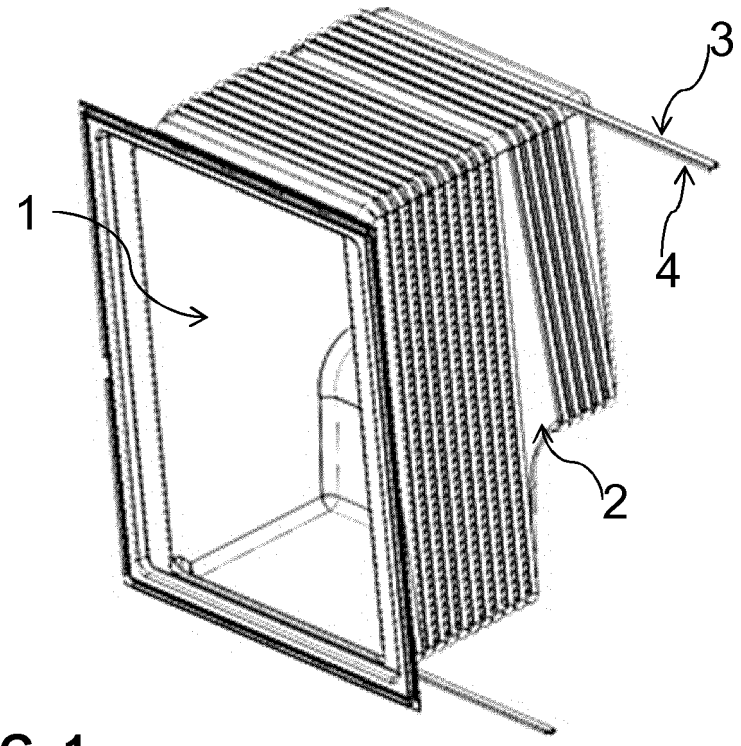

FIG. 1

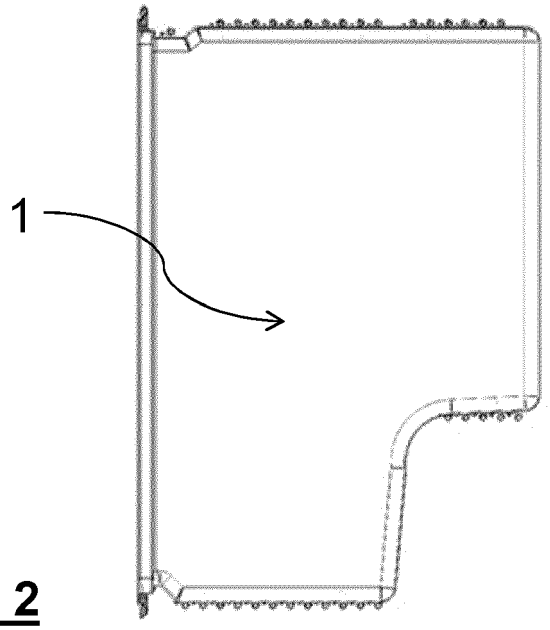

FIG. 2

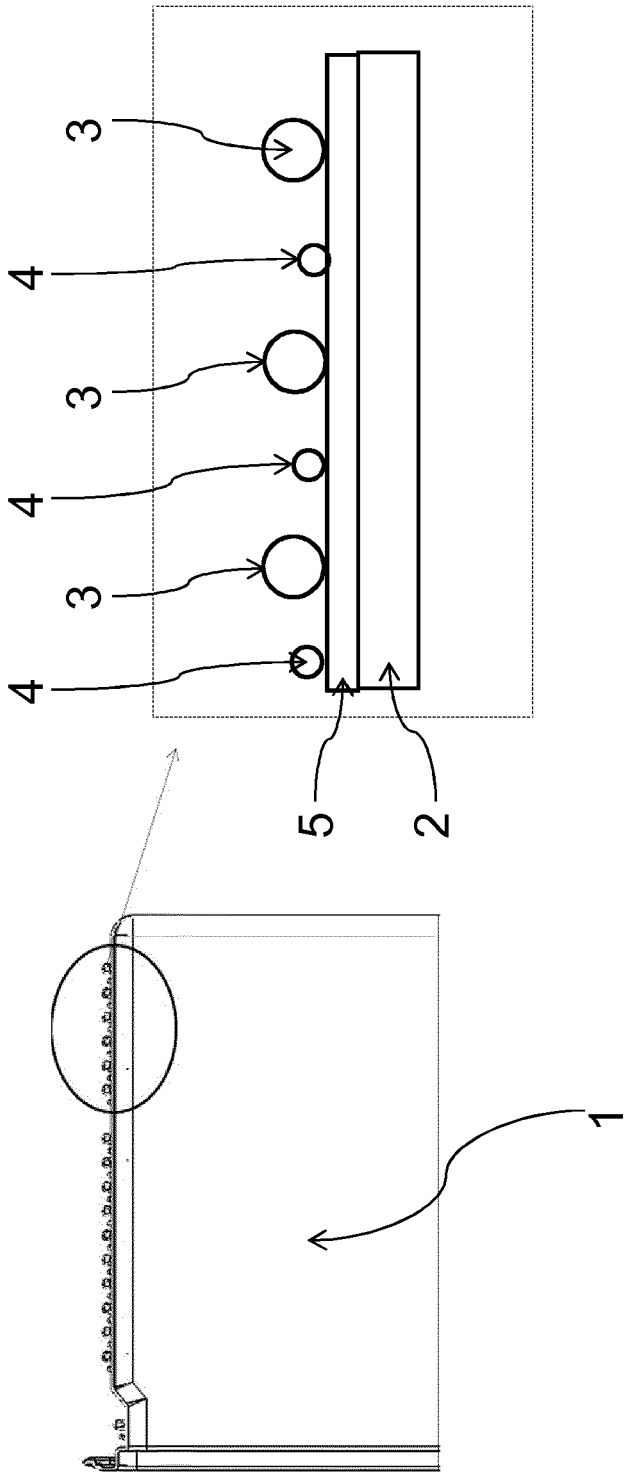

FIG. 3

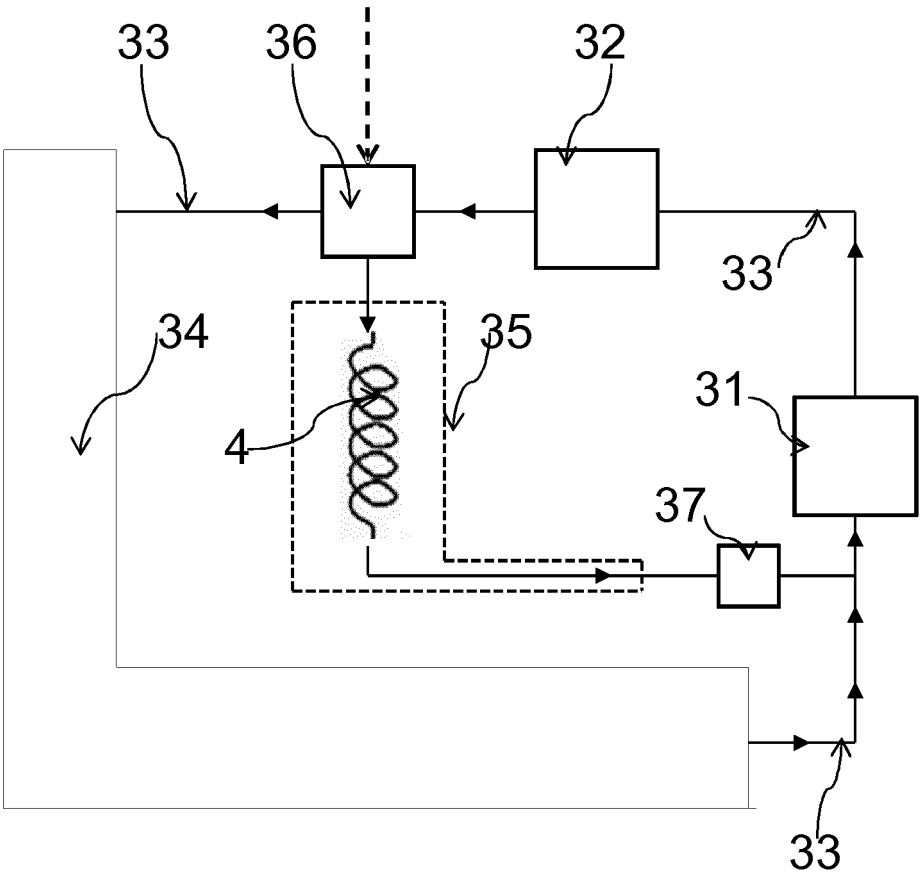

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 9202

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2 802 346 A (SIMMONS EDWARD C) 13 August 1957 (1957-08-13) * column 1, lines 18-43 * * column 2, line 67 - column 4, line 5 * * column 5, lines 35-40; figures * -----	1,2,4-7, 9-13 3,8	INV. F25D21/06 F25D21/08
Y	CA 2 552 454 A1 (W C WOOD COMPANY LTD [CA]) 17 January 2008 (2008-01-17) * figure 2 * -----	3	
Y	DE 20 2005 006284 U1 (WENZEL BERNHARD [DE]) 16 June 2005 (2005-06-16) * claim 1; figures 1a,1b * -----	8	
A	US 6 230 511 B1 (LEE JANG SEOK [KR] ET AL) 15 May 2001 (2001-05-15) * column 1, lines 38-50 * * column 2, lines 35-46 * * column 3, lines 34-45; figures 2,3 * -----	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

F25D
F25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 November 2015	Vigilante, Marco

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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