



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.09.2011 Bulletin 2011/39

(51) Int Cl.:
F25D 23/02 (2006.01)

(21) Application number: **11157602.1**

(22) Date of filing: **10.03.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **23.03.2010 IT RN20100009**

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

(72) Inventors:
• **Pieri, Marco**
61405 Pergola (PU) (IT)
• **Sabatini, Giorgio**
63030 Colli del Tronto (AP) (IT)

(74) Representative: **Santonicola, Paolo**
Indesit Company S.p.A.
Industrial Property Management Team
Via Lamberto Corsi, 55
60044 Fabriano (AN) (IT)

(54) **Electrical household appliance for cooling food**

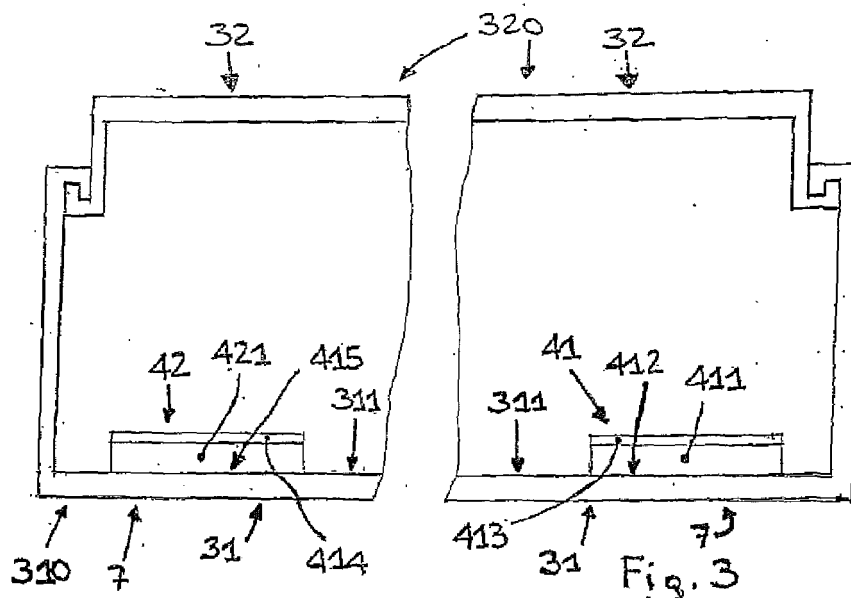
(57) An electrical household appliance for cooling and storing food comprises a cooled compartment (2) for receiving the food to be stored and a door (3) giving access to said compartment (2), the door (3) in turn comprising:

-a first face (31) directed towards the outside of the electrical household appliance (1), a second face (32) at least partly directed towards the cooled compartment (2) when

the door (3) is closed;

-structural reinforcement means (4) interposed between the first and the second face (31, 32) and comprising at least one insert (41).

The first insert (41) comprises a first layer of material (411) comprising an epoxy resin, the first insert (41) being applied to a support (7) at least partly interposed between the first and the second face (31, 32).



Description

[0001] This invention relates to an electrical household appliance for cooling and storing food.

[0002] In prior art electrical household appliances for cooling and storing food, a door giving access to a cooled compartment for storing the food is subject to deformation during use. The deformation is normally attributable to the temperature difference between the inside and the outside of the compartment. More specifically, the deformation causes the door to change from a substantially flat shape to a shape where it is slightly curved outwards. This problem affects mostly, but not only, household food cooling and storing appliances having a single door and where the extension of the door in a first direction (typically the vertical one) is much greater than in the other directions at right angles to the first direction (the effect is much more evident in freezers because the thermal gradient is steeper). Normally, the door comprises a first face directed towards the outside of the cooling appliance, a second face directed towards the cooled compartment and an outer edge which is interposed between the first and the second face and which extends principally along a closed rectangular line of extension. The two long sides of the rectangular outer edge extend vertically. The door has hinges for connecting it to the rest of the electrical household appliance, these hinges being located on one of the two long sides of the rectangular edge. It has been found that the above mentioned deformation is usually greater along one of the two long sides of the rectangular edge.

[0003] The thermal gradient between the inside and the outside of the compartment causes shrinkage of the material on the first face of the door, eventually leading to outward warping of the door. In some cases, the warping may cause the concertinaed seal attached to the door to open, thus reducing its insulating capacity (when the door is closed, the seal is normally pressed against a frame that surrounds the opening giving access to the food cooling compartment; the seal having a magnet which is attracted to the metal surface of the frame). At times, the warping may also cause the seal to be detached from the frame against which it is normally in contact when the door is closed (thus letting in warm, moist air from the outside).

[0004] To overcome this problem, refrigerators are known which have a door extending in a vertical plane and inside of which, between the first face and the second, there are two vertical metal bars of suitable section for stiffening the door structure.

[0005] This solution, though it reduces the deformation of the door, has inherent disadvantages due to a considerable increase in the weight of the door and a corresponding increase in costs.

[0006] In this context, the technical purpose which forms the basis of this invention is to propose an electrical household appliance for cooling and storing food that overcomes the above mentioned disadvantages of the

prior art.

[0007] More specifically, the aim of this invention is to provide an electrical household appliance for cooling and storing food and in which the weight of the door can be limited.

[0008] The technical purpose and aim specified are substantially achieved by an electrical household appliance for cooling and storing food and comprising the technical features described in one or more of the appended claims.

[0009] Further features and advantages of the invention are more apparent in the non-limiting description which follows of a preferred non-limiting embodiment of an electrical household appliance for cooling and storing food as illustrated in the accompanying drawings, in which:

- Figure 1 is a schematic view of an electrical household appliance for cooling and storing food according to this invention;
- Figure 2 is a front view of a door according to the invention where some parts not in view are shown with dashed lines;
- Figure 3 shows a partly interrupted view of a cross section through the plane A-A of Figure 2.

[0010] With reference to the accompanying drawings, the numeral 1 denotes an electrical household appliance for cooling and storing food.

[0011] The electrical household appliance 1 comprises: a cooled compartment 2 for receiving the food to be stored and a door 3 giving access to the compartment 2.

[0012] For example, the electrical household cooling appliance 1 may be a freezer or a refrigerator with freezer compartment (as shown in Figure 1, for example) or a refrigerator-freezer combination structure (in that case, there may be a single door giving access to both the cooling compartment and the freezer compartment or there may be two or more separate doors).

[0013] The door 3 in turn comprises:

- a first face 31 directed towards the outside of the electrical household appliance 1, a second face 32 at least partly directed towards the cooled compartment 2 (at least when the door 3 is closed; when the door 3 is closed, the second face 32 contributes to delimiting the cooled compartment 2; the first face and the second face 31 and 32 are opposite one another);
- structural reinforcement means 4 interposed between the first and the second face 31, 32 and comprising at least a first insert 41.

[0014] The door 3 extends in thickness between the first face and the second face 31, 32.

[0015] If there are two cooled compartments delimited by a single door 3, the second face 32 is partly directed towards one of the two cooled compartments and partly

directed towards the other of the two cooled compartments (when the door 3 is closed). In an alternative embodiment where the door 3 delimits a single cooled compartment 2, the second face 32 is directed towards the cooled compartment 2.

[0016] The second face 32 forms part of the component sometimes referred to as "inner door panel" in the jargon of the trade. In the preferred embodiment, the perimeter of the first face 31 and/of the second face 32 is approximately rectangular.

[0017] The first insert 41 comprises a first layer 411 of material. Conveniently, the first layer 411 of material comprises an epoxy resin.

[0018] The first insert 41 is applied to a support 7 which is at least partly interposed between the first and the second face 31, 32. The support 7 is conveniently metallic. The first face 31 is integrated in the support 7. The first insert 41 comprises a second layer 413 comprising a composite material (more specifically, it comprises fibreglass). The second layer 413 is adjacent to the first layer 411, the first layer 411 being interposed between the support 7 and the second layer 413.

[0019] Conveniently, the first insert 41 is made with a product available under the trade name "Nitohard" by Nitto Denko. More specifically, the first insert 41 is made with a product available under the trade name "Nitohard RE-1000" by Nitto Denko. An example of the first insert 41 is disclosed in patent document EP1531040.

[0020] The first layer 411 comprises an adhesive surface 412 by which the first layer 411 is glued to the support 7.

[0021] The adhesive surface 412 covers the surface of the first layer 411 opposite the one that interfaces with the second layer 413.

[0022] Advantageously, the door 3 comprises a panel 310 which the first face 31 forms part of, and a coating 320 which the second face 32 forms part of. Advantageously, the first insert 41 and the first layer 411 are interposed between the panel 310 and the coating 320. Advantageously, the panel 310 is made of a metallic material. The panel 310 advantageously coincides with the support 7. The first face 31 is thus integrated in the support 7 and the first insert 41 is applied to a surface 311 of the support 7 opposite the first face 31. The coating 320 coincides with the inner door panel of the door 3. The coating 320 is normally made of a plastic material.

[0023] The invention makes it possible to decrease the weight of the first insert 41 considerably compared to a known solution where there is a metallic upright inside the door. The weight of the door 3 is thus reduced without penalizing the structural stiffness features needed to resist the deformation of the door 3 caused by the cyclical thermal gradient existing between the inside and the outside of the compartment 2. Before the electrical household appliance 1 is finished, the first layer 411 undergoes a heat treatment which causes it to expand and acquire its final structural resistance properties.

[0024] The door 3 comprises an edge 33 which is in-

terposed between the first face and the second face 31 and 32 and which extends principally along a closed, rectangular line of extension.

[0025] The four sides of the closed, rectangular line of extension comprise a first and a third side 331, 333, which are parallel with each other and not consecutive, and a second and a fourth side 332, 334 which are parallel with each other and not consecutive.

[0026] The first and the third side 331, 333 are greater in length than the second and the fourth side 332, 334.

[0027] The edge 33 comprises a first, a second, a third and a fourth part 335, 336, 337, 338 which extend, respectively, along the first, the second, the third and the fourth side 331, 332, 333, 334 of the line of extension of the edge 33. Considered individually, the first, second, third and fourth parts 336, 336, 337, 338 do not necessarily extend in a single plane. Purely by way of an example, the first, second, third and fourth parts 335, 336, 337, 338 of the edge 33, if observed from the first face towards the second face 31, 32 or vice versa, might each have a step in it.

[0028] The first insert 41 extends along a principal direction of extension 410.

[0029] The first layer 411 extends for a length which is greater than or equal to one half, preferably three quarters, of the length of the first or third side 331, 333. Conveniently, the first layer 411 extends for a length which is approximately equal to the length of the first and/or third side 331, 333.

[0030] The extensions of the first insert 41 along the principal direction of extension 410 of the first insert 41 cross the second and the fourth part 336, 338 of the edge 33.

[0031] This orientation of the principal direction of extension 410 of the first insert 41 makes it possible to optimize the structural resistance of the door 3 to deformation caused by the thermal gradient between the inside and outside of the compartment 2. In effect, deformation mostly affects a segment that extends between a point on the second side and a point on the fourth side 332, 334 (that is to say, it occurs along the principal direction of extension of the door 3). That is the case whether the door 3 extends mainly vertically (as for example in the embodiment of Figure 1) or mainly horizontally (in the latter case — an embodiment which is not illustrated — under the door 3 there is usually a chest in which the food to be kept in cold storage is placed). The embodiment with vertical door 3 applies to refrigerators, freezers or combined refrigerator-freezers, whilst the embodiment with horizontal door applies almost exclusively to freezers.

[0032] Let us define an imaginary reference plane 5 interposed between the first and the third side 331, 333 and equidistant from the first and the third side 331, 333.

[0033] More specifically, the imaginary plane 5 is interposed between the first and the third part 335, 337 of the edge 33 of the door 3 and is equidistant from them. Preferably, the imaginary plane 5 is substantially a plane

of symmetry of the edge 33 of the door 3. Advantageously, the imaginary plane 5 is at right angles to the first face 31 (if the latter extends substantially in a single plane). The electrical household appliance 1 comprises at least one hinge 6 for connecting the door 3 to the rest of the electrical household appliance 1. The hinge 6 is applied at the first part 335 of the edge 33.

[0034] This is the case, especially but not exclusively, of electrical household cooling and storage appliances 1 with vertical door 3.

[0035] The first insert 41 is entirely interposed between the imaginary plane 5 and the third part 337 of the edge 33. The part of the door 33 along the long side of the edge 33 of the door 3 and furthest from the hinge 6 is usually the part most subject to deformation caused by the thermal gradient between the inside and outside of the cooled compartment 2. Thus, the presence of one or more hinges 6 might contribute to connecting the first part 335 of the edge 33 of the door 3 while limiting the latter's deformation.

[0036] The structural reinforcement means 4 comprise a second insert 42 comprising a third layer 421 of material. Conveniently, the third layer 421 of material comprises an epoxy resin.

[0037] Conveniently, the second insert 42 is made with a product available under the trade name "Nitohard" by Nitto Denko. More specifically, the second insert 42 is made with a product available under the trade name "Nitohard RE-1000" by Nitto Denko. Conveniently, the second insert 42 is applied to the support 7. The second insert 42 comprises a fourth layer 414 adjacent to the third layer 421 and made of a composite material (for example, fibreglass). The third layer 421 is conveniently interposed between the fourth layer 414 and the support 7.

[0038] The third layer 421 comprises an adhesive surface 415 by which the third layer 421 is glued to the support 7. The second insert 42 is applied to the surface of the support 7 opposite the first face 31 (the same surface the first insert 41 is applied to). The adhesive surface 415 extends over the surface of the third layer 421 opposite the one that interfaces with the fourth layer 414.

[0039] Conveniently, the second insert 42 and the third layer 421 are interposed between the panel 310 and the coating 320.

[0040] The second insert 42 extends along a principal direction of extension 420.

[0041] In the expressions "third layer" and "fourth layer" the adjectives "third" and "fourth" are used to distinguish them from the "first layer" and the "second layer" relating to the first insert 41. The adjectives "third" and "fourth" do not imply that the second insert 42 also has a first and a second layer (not further specified) applied to it. Also, the materials the first insert 41 is made of advantageously coincide with those the second insert 42 is made of. Preferably, the first and/or the second layer 411, 413 are made of the same materials as the third and/or the fourth layer 421, 414 are made of, respectively.

[0042] The second insert 42 is entirely interposed between the imaginary plane 5 and the first part 335 of the edge 33.

[0043] The second insert 42 extends for a length which is greater than or equal to at least one half, preferably three quarters, of the length of the first or third side 331, 333. Conveniently, the second insert 42 extends for a length which is approximately equal to the length of the first or third side 331, 333.

[0044] The first insert 41 is located close to the third part 337 of the edge 33 and the second insert 42 is located close to the first part 335 of the edge 33.

[0045] The first insert 41 may be regarded as an upright of the door 3. The same applies to the second insert 42.

[0046] The principal direction of extension of the second insert 42 is parallel to the principal direction of extension of the first insert 41.

[0047] The support 7 extends in thickness between the first face 31 and a second face 32 inside the door 3. Advantageously, the first and/or the second insert 41, 42 is/are applied (preferably glued) to the surface 311 of the support 7 opposite the first face 31.

[0048] The door 3 conveniently comprises thermal insulation means. The thermal insulation means comprise a solidified polyurethane foam interposed between the first and the second face 31, 32. For example, the solidified polyurethane foam might enclose the first and/or the second insert 41, 42. The thermal insulation means might also comprise one or more VIP panels interposed between the first and the second face 31, 32 of the door 3. In that case, the VIP panels would be located between the first or the second insert 41, 42 and the second face 32.

[0049] This invention also has for an object a method for making the door 3 of an electrical household appliance 1 having one or more of the technical features described above. The method comprises the steps of:

- procuring the panel 310;
- connecting to the panel 310 at least the first insert 41 comprising the first layer 411 of material comprising an epoxy resin, the first layer 411 of material being thermally expandable;
- heating the panel 310 and the first layer 411 to a temperature greater than or equal to a predetermined temperature and for a length of time greater than or equal to a predetermined length of time to allow the first layer 411 to expand and harden;
- connecting to the panel 310 the coating 320 comprising the second face 32, the first insert 41 remaining interposed between the panel 310 and the coating 320.

[0050] Conveniently, the method comprises a step of applying a layer of powdered paint to a first surface of the panel 310, the panel 310 coinciding with the support 7 and the first surface being at least partly designed to form part of the first face 31 of the door 3; the step of

applying a layer of powdered paint to the first surface of the panel 310 is performed before the step of heating the panel 310 and the first layer 411 so that, during the subsequent step of heating the panel 310 and the first layer 411, the powdered paint can melt and expand simultaneously with the expansion and hardening of the first layer 411.

[0051] Advantageously, the predetermined temperature is 170°, preferably 180°. Conveniently, the predetermined length of time is 7 minutes, preferably equal to 10 minutes.

[0052] The step of connecting the coating 320 to the panel 310 may be performed before or after the step of heating the panel 310 and the first layer 411: preferably after. After connecting the coating 320 to the panel 310, an insulating material, in particular a polyurethane foam which allows better thermal insulation, is placed in the space between the panel 310 and the coating 320.

[0053] The step of rigidly connecting to the panel 310 at least the first metallic insert 41 to which is applied the first layer 411 of material comprising an epoxy resin entails connecting the first insert to the panel 310 by gluing. To perform the gluing step, a protective film is removed from the adhesive layer 412 of the first layer 411. A similar operation is performed on the second insert 42 if the second insert 42 needs to be connected to the panel 310; in that case, a protective film is removed from the adhesive surface 415.

[0054] Lastly, the door 3 is connected to the rest of the electrical household appliance 1 by at least one hinge 6. Preferably, the step of connecting the first insert 41 to the panel 310 is accompanied by the step of connecting the second insert 42 to the panel 310. Similarly, the step of heating the panel 310 and the first layer 411 is simultaneous with the step of heating the third layer 421.

[0055] This invention has important advantages. In particular, it allows a reduction of the weight of the means used for stiffening the door giving access to the cooled compartment but without affecting its structural resistance. That allows the construction of doors which, under equal conditions of structural resistance, are lighter in weight and thus easier for a user to move (this is particularly advantageous considering the fact that the door of a household refrigerator or freezer is normally opened and closed by anyone in the family, including children). The lighter weight also facilitates on-line assembly.

[0056] It shall be understood that the invention described above may be modified and adapted in several ways without departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by other technically equivalent elements. Further, the embodiments of the invention may be made in any size, depending on requirements.

Claims

1. An electrical household appliance for cooling and

storing food comprising a cooled compartment (2) for receiving the food to be stored and a door (3) giving access to the compartment (2), the door (3) in turn comprising:

- a first face (31) directed towards the outside of the electrical household appliance (1), a second face (32) at least partly directed towards the cooled compartment (2) when the door (3) is closed;
- structural reinforcement means (4) interposed between the first and the second face (31, 32) and comprising at least one insert (41);

characterized in that the first insert (41) comprises a first layer of material (411) comprising an epoxy resin, the first insert (41) being applied to a support (7) at least partly interposed between the first and the second face (31, 32).

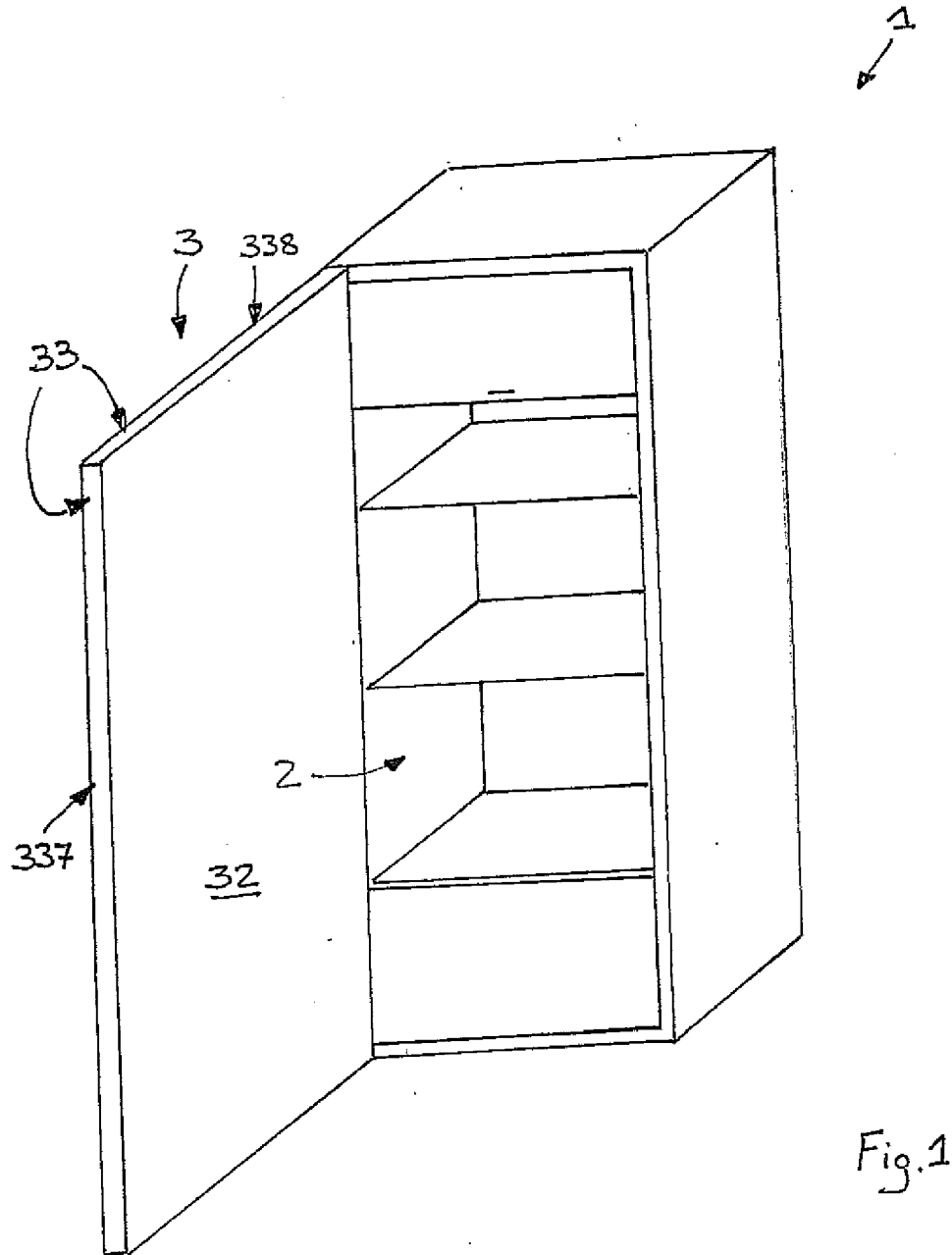
2. The electrical household appliance according to claim 1, **characterized in that** the support (7) is made of metal and the first layer (411) comprises an adhesive surface (412) by which the first insert (41) is glued to the support (7).
3. The electrical household appliance according to claim 1 or 2, **characterized in that** the first face (31) is integrated in the support (7).
4. The electrical household appliance according to any of the foregoing claims, **characterized in that** the door (3) comprises an edge (33) which is interposed between the first and the second face (31, 32) and which extends principally along a closed, rectangular line of extension, the four sides of the closed, rectangular line of extension comprising a first and a third side (331, 333), which are parallel with each other and not consecutive, and a second and a fourth side (332, 334) which are parallel with each other and not consecutive, the first and the third side (331, 333) being greater in length than the second and the fourth side (332, 334); the edge (33) comprising a first, a second, a third and a fourth part (335, 336, 337, 338) which extend, respectively, along the first, the second, the third and the fourth side (331, 332, 333, 334) of the line of extension of the edge (33).
5. The electrical household appliance according to claim 4, **characterized in that** the first insert (41) extends along a principal direction of extension (410), the extensions of the first insert (41) along the principal direction of extension (410) of the first insert (41) crossing the second and the fourth part (336, 338) of the edge (33).
6. The electrical household appliance according to claim 4 or 5, where an imaginary reference plane (5)

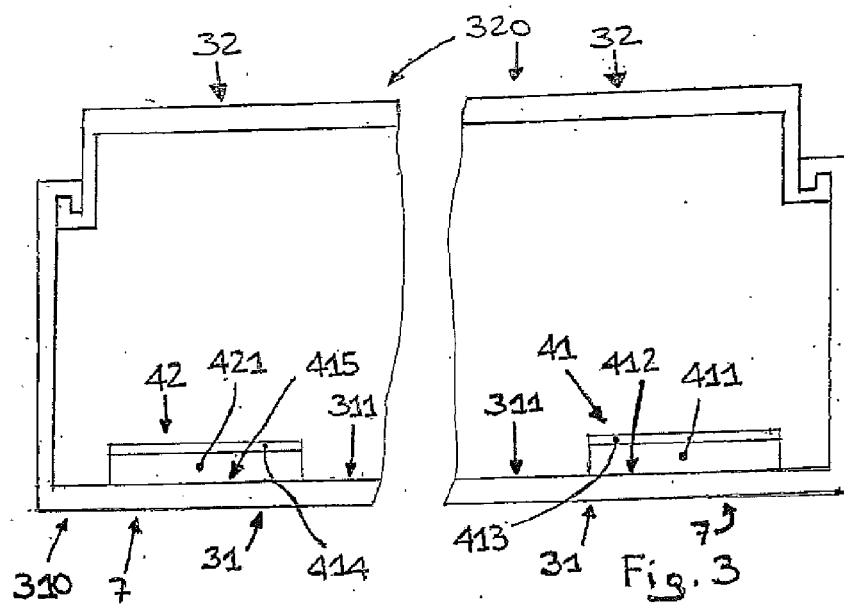
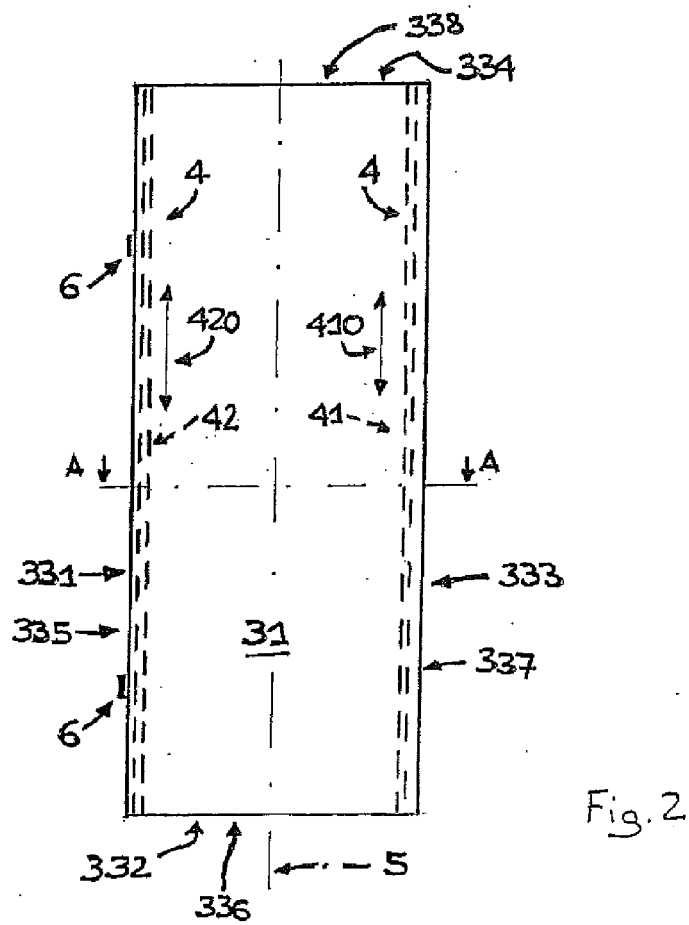
is interposed between the first and the third side (331, 333) and is equidistant from the first and the third side (331, 333), **characterized in that** it comprises at least one hinge (6) for connecting the door (3) to the rest of the electrical household appliance (1), the hinge (6) being applied at the first part (335) of the edge (33); the first insert (41) being entirely interposed between the imaginary plane (5) and the third part (337) of the edge (33).

7. The electrical household appliance according to any of the foregoing claims, **characterized in that** the structural reinforcement means (4) comprise a second insert (42) extending along a principal direction of extension (420) and comprising a second layer (413) of material which is applied to the support (7) and which comprises an epoxy resin.
8. The electrical household appliance according to claim 7 when it depends directly or indirectly on claim 6, **characterized in that** the second metal insert (42) is entirely interposed between the imaginary plane (5) and the first part (335) of the edge (33).
9. The electrical household appliance according to claim 8 or according to claim 7 when it depends directly or indirectly on claim 4, **characterized in that** the first insert (41) is located close to the third part (337) of the edge (33) and the second insert (42) is located close to the first part (335) of the edge (33).
10. The electrical household appliance according to claim 7, 8 or 9, **characterized in that** the principal direction of extension of the second insert (42) is parallel to the principal direction of extension of the first insert (41).
11. A method for making the door of the electrical household appliance according to any of the foregoing claims from 1 to 10, **characterized in that** it comprises the following steps:
 - procuring a panel (310);
 - gluing to the panel (310) at least the first insert (41) comprising the first layer (411) of material comprising an epoxy resin, the first layer (411) being thermally expandable;
 - heating the panel (310) and the first layer (411) to a temperature greater than or equal to a predetermined temperature and for a length of time greater than or equal to a predetermined length of time to allow the first layer (411) to expand and harden;
 - connecting to the panel (310) a coating (320) comprising the second face (32), the first insert (41) remaining interposed between the panel (310) and the coating (320).

12. The method according to claim 11, **characterized by:**

- applying a layer of powdered paint to a first surface of the panel (310), the panel (310) coinciding with the support (7) and the first surface being at least partly designed to form part of the first face (31) of the door (3); this step being performed before the step of heating the panel (310) and the first layer (411) so that, during the subsequent step of heating the panel (310) and the first layer (411), the powdered paint can melt and expand simultaneously with the expansion and hardening of the first layer (411).







EUROPEAN SEARCH REPORT

Application Number
EP 11 15 7602

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	GB 508 413 A (ELECTROLUX LTD) 30 June 1939 (1939-06-30) * the whole document *	1,3	INV. F25D23/02
X	US 2005/257495 A1 (CHOI CHANG B [KR]) 24 November 2005 (2005-11-24) * the whole document *	1	
X	US 6 190 490 B1 (TIPPMANN JOSEPH R [US] ET AL) 20 February 2001 (2001-02-20) * the whole document *	1-5	
A		11,12	
A	JP 2008 132604 A (MATSUSHITA ELECTRIC IND CO LTD) 12 June 2008 (2008-06-12) * the whole document *	1-12	
A	US 2004/266899 A1 (MUENZ XAVER [DE] ET AL) 30 December 2004 (2004-12-30) * the whole document *	1-12	TECHNICAL FIELDS SEARCHED (IPC) F25D C08L
A	US 2004/241413 A1 (BLAZEK FELISA [US]) 2 December 2004 (2004-12-02) * the whole document *	1-12	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 June 2011	Examiner Lucic, Anita
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			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 15 7602

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-06-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 508413	A	30-06-1939	NONE
US 2005257495	A1	24-11-2005	JP 2005274130 A 06-10-2005
US 6190490	B1	20-02-2001	US 2001032699 A1 25-10-2001
JP 2008132604	A	12-06-2008	NONE
US 2004266899	A1	30-12-2004	NONE
US 2004241413	A1	02-12-2004	US 2006210755 A1 21-09-2006

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1531040 A [0019]