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(71) Applicant: **MACCAGNOLA S.r.l.**
25017 Lonato del Garda (BS) (IT)

(72) Inventor: **MACCAGNOLA, Alcide**
25017 Lonato del Garda (BS) (IT)

(74) Representative: **Pes, Matteo**
Biesse S.r.l.
Patent Department (sesto piano)
Via Corfù, 71
25124 Brescia (BS) (IT)

(54) **TRANSPARENT PANEL**

(57) A double-glazing panel is described, comprising at least two glass sheets and one frame extending along the perimeter of the glass sheets. The glass sheets are supported parallel to one another only by the frame. A chamber containing air or gas, isolated from the outside, is defined between the adjacent glass sheets and the frame. In its own turn, the frame consists of one or more profiles directly glued to the glass sheets, just at the respective edges. Advantageously, at least some profiles are transparent, i.e. at least part of the frame is transparent. The panel assembly is very easy and quick at the same time. The profiles can be made separately before the panel assembly, with low costs. For example, the profiles are made of a plastic material, and are extruded or molded.

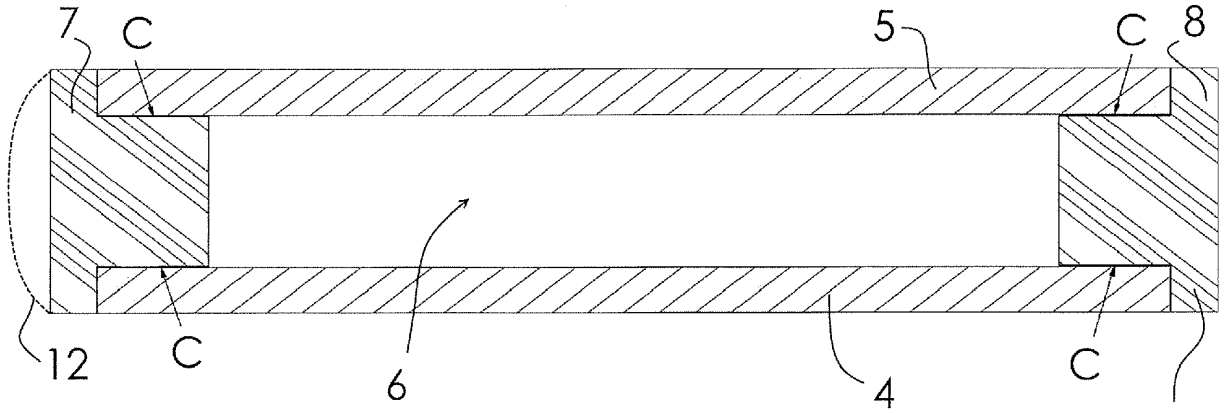

Fig. 4

EP 3 385 486 A1

Description

Field of the Invention

[0001] Object of the present invention is a transparent panel intended for being used as access door for fridges or showcases, or as partition wall of showcases and displays.

State of the Art

[0002] More and more often fridges installed in supermarkets for selling frozen or deep-frozen products have substantially transparent doors, that allow clients seeing the products inside the fridge and, thus, allow a product to be selected before opening the door. This way, buyers are prevented from unnecessarily opening fridge doors, looking for the desired product, with subsequent energy waste.

[0003] The transparent doors are further used also for showcases and exposition cabinets, such as the displays.

[0004] Usually transparent doors for fridges are of the double-glazing type, also named double layer glass type: at least two glass sheets are coupled to a frame such to remain parallel and to define an interstice therebetween, filled with air or noble gases and acting as heat insulating.

[0005] The frame develops along the perimeter of the glass sheets, as a frame. Conventionally the frame is made of metal sections, for example made of aluminium, and the glass sheets are air-tight glued to such sections. Hinges and fitting needed to allow to serve as a door, for example pivots, are mounted on the frame.

[0006] Recently an aesthetically valuable solution has been presented, that does not provide the use of the frame.

[0007] EP-B-2878233 describes a transparent panel obtained by coupling one to another at least two (transparent) glass sheets only by means of a glue that is itself transparent after the respective setting. The glue is applied at the edge of the sheets and, once hardened, constitutes a connecting element and at the same time ensures air tightness, i.e. preserves the insulating effect of the double-glazing. If needed, metal reinforcements are inserted in the panel at the corners.

[0008] In EP-B-2878233 the glue application technique is also described. At the beginning the glass sheets to be coupled are kept parallel, at a distance corresponding to the interstice to be created between the sheets, and they are partially dipped in a vessel containing the liquid phase glue. The sheet dipping is provided at the respective edges. After the glue is arranged between the sheets, the glue is let solidify, for example by UV or hot air polymerization, and this operation takes long time; the sheets are then extracted from the vessel and rotated in order to repeat the operation for all sides, until the perimeter has been completed.

[0009] The Applicant found that the solution described in EP-B-2878233 is hard to implement and that manufacturing times are long, taking into account the fact that the glue solidification on each edge of the panel has to be waited for.

Summary of the Invention

[0010] Object of the present invention is therefore to provide a completely transparent panel, made by a technique easier than that described in EP-B-2878233 and with lower costs.

[0011] In other words, the present invention has the aim of providing a double-glazing panel that is transparent at the edges also, i.e. at the frame, while being easy to implement with low costs and in short times.

[0012] The present invention relates therefore to a double-glazing panel comprising at least two glass sheets and one perimetrical frame, i.e. a frame extending along the perimeter of the glass sheets. The glass sheets are supported parallel to one another only by the frame, thus the latter constituting a structural as well as an aesthetic element. A chamber containing air or gas, sealingly isolated from the outside, is defined between the adjacent glass sheets and the frame.

[0013] The frame consists of one or more profiles directly glued to the glass sheets, just at the respective edges.

[0014] Advantageously, differently from conventional solutions, at least one of the profiles is transparent and preferably most of the frame, or all, is transparent.

[0015] The proposed solution allows obtaining the pleasant aesthetic result described in relation to the known art, but without incurring in the related drawbacks. The transparent profiles are not constituted by glue that is transparent when solidified, as provided in EP-B-2878233; therefore, the panel assembly is much easier, the final result being the same.

[0016] In fact, the profiles can be made separately before the panel assembly, with very low costs.

[0017] In the preferred embodiment, the profiles are made of a plastic material, for example polycarbonate.

[0018] Preferably the profiles are extruded, even if alternatively, they can be obtained by the moulding technique.

[0019] Once the profiles have been made, these can be used for the assembly, as the metal profiles, but with the advantage of being transparent.

[0020] Preferably the glass sheets are rectangular or square. In this instance the profiles are four, a left vertical profile, a right vertical profile, a top horizontal profile and a bottom horizontal profile. Each one of the profiles is glued to at least two glass sheets, so as to also act as spacer in order to obtain the inner chamber, or to all the glass sheets (one profile per each panel edge) if these are more than two, at the respective edges.

[0021] At least one of the vertical profiles is transparent, and preferably both the right and left vertical profiles are transparent. The remaining profiles, the top and the

bottom ones, can be transparent or not.

[0022] For example, if the panel comprised three glass sheets and two inner chambers, the two chambers would be however limited by the sheets and the frame profiles. Alternatively, if the panel comprised three glass sheets and two inner chambers, two profiles could be used per each panel edge: a profile for connecting the first glass sheet with the second glass sheet and another profile for connecting the second glass sheet with the third glass sheet.

[0023] Preferably the transparent profiles have T-shaped cross section. The glass sheets are glued to the profiles at the longitudinal portion of the T shape, at opposite sides, and in abutment against the transversal portion of the T shape.

[0024] The glass sheets are preferably glued to the transparent profiles so as to be flush with the profiles themselves, i.e. in such a way to create a single panel with seamless outer surfaces, free from slots or undercuts.

[0025] In the preferred embodiment of the present invention the glass sheets are glued to the transparent profiles by means of a transparent glue. The glue also acts as sealant of the chamber containing air or gases.

[0026] Preferably at least one of the profiles comprises a first inner seat in which dehydrating salts are housed. Salts have the task of absorbing humidity from the inner chamber, to prevent condensation from forming on the glass sheets. It is a real risk, mostly if the panel is used as fridge door. More preferably, the profiles provided with the housing seat for dehydrating salts are the top profile and the bottom profile, that can also be not transparent and, thus, can hide salts.

[0027] Another optional feature of the panel, for which the Applicant reserves the right to deposit a divisional Patent Application, consists in that at least one of the profiles, and preferably the two bottom and top profiles, comprises a second inner seat in which a bar is housed. The bar has a double function:

- it is a hinge anchoring element for the use of the panel as door or window, for example by means of screws passing through the material of the respective profile;
- it is a limiting element to limit deformations the panel is subjected to, in case of violent or quick impacts at the stop, since the bar prevents the glass sheets from flexing or twisting up to the breaking point. Advantages offered by the bar can be obtained independently of the profiles being transparent or not; for this reason, the Applicant reserves the right to deposit a divisional Patent Application, subordinating the other technical features described in the present application.

[0028] Preferably the bars are flat, i.e. they are battens and extend for the whole length of the edge of the respective glass sheets.

[0029] A second aspect of the present invention relates to a method for making a double-glazing panel, for the use as door or window, comprising:

a) extruding or moulding one or more profiles made of a transparent plastic material;
b) gluing with transparent glue at least two glass sheets to the profiles, at the edges of the glass sheets, so that the profiles remain interposed between the parallel glass sheets and, between the latter, a chamber containing air or gas is defined;
c) causing the solidification of the glue and isolating the chamber between the glass sheets and the profiles.

[0030] It is apparent that the panel assembly can be feasible in much shorter times with respect to the solution described in EP-B-2878233, that provides for dipping the panel one side at a time in the glue and solidifying a large amount of glue, that has to become itself a solid edge of the panel.

Brief list of the figures

[0031] Further characteristics and advantages of the invention will be better evident by the review of the following specification of a preferred, but not exclusive, embodiment illustrated for illustration purposes only and without limitation, with the aid of the accompanying drawings, wherein:

- figure 1 is a front view of an industrial fridge whose doors are transparent panels according to the present invention;
- figure 2 is a perspective view of a transparent panel according to the present invention;
- figure 3 is an exploded front view of the panel shown in figure 2;
- figure 4 is a sectional view taken along the horizontal plane H-H of figure 2;
- figure 5 is a sectional view taken along the vertical plane V-V of figure 2.

Detailed description of the invention

[0032] Figure 1 frontally and schematically shows a refrigerator 1 of the type used in supermarkets for selling fresh, frozen or deep-frozen foods.

[0033] In the example shown, the refrigerator 1 is provided with four transparent doors 2 hinged openable by holding an appropriate handle.

[0034] Figure 2 shows a single panel 2. In conventional solutions, the frame 3 of the panels used as refrigerator doors is matt, since consisting of a metal frame; in the panel 2, instead, the frame 3, i.e. the panel perimeter, is at least partly transparent.

[0035] Figures 3-5 allow explaining how this result is obtained. Figure 3 is an exploded front view and figures

4 and 5 are cross sectional views taken respectively on the horizontal H-H and vertical V-V planes. The views are not to scale, for greater clarity.

[0036] With the reference numeral 4 a glass sheet is denoted. Parallel to the sheet 4 there is a second glass sheet 5 and between the two sheets 4 and 5 a double glazing 6 is defined, i.e. a chamber in which air is confined or a gas is confined, for example argon, in order to maximize the thermal insulation, i.e. to reduce the transmittance of the door 2 and to limit the BTU loss from the refrigerator.

[0037] Preferably the glass sheet 4, the outer one with respect to the refrigerator, is obtained by float process and stands out for a low content of iron oxides.

[0038] Preferably the glass sheet 5 has high level of light transmission (LT equal to at least 70%) and an excellent thermal insulation (Ug = 1.0 W/(m^2K)).

[0039] If appropriate, the glass sheets are screen-printed or otherwise customized with stickers, for providing the users with indications or simple commercial information.

[0040] Differently from conventional solutions providing the use of metal profiles or glue to keep together the glass sheets 4, 5, the panel 2 according to the present invention provides the use of a plurality of profiles 7-10, some of which 7-8, or all of them, being transparent.

[0041] In the example shown in figures, the side profiles 7-8 are made of a transparent material, preferably polycarbonate PC, and are glued to the glass sheets 4, 5. The top and bottom profiles 9, 10 can be made of metal or a plastic material, for example still in polycarbonate, and in this instance, they can be transparent or not.

[0042] In the preferred embodiment, the profiles 7-10 are extruded. This way, seats can be obtained in the profiles 7-10, as it will be explained later, during the extrusion step already.

[0043] Alternatively, the profiles 7-10 can be moulded.

[0044] Preferably, the profiles 7-10 are slightly flexible and not completely stiff as the conventional metal profiles. This feature allows the assembly of the panel 2 to be facilitated, as it will be clear from the following description.

[0045] The panels 2 can be assembled in the following way.

[0046] Firstly, the glass 4 is placed in a properly made mask (not shown); then a layer C of transparent high-strength adhesive material is cold spread, at the edges of the glass sheet 4, where the coupling with the profiles 7-10 is provided. Then the two top 9 and bottom 10 profiles are positioned (horizontal profiles of the panel 2), and the two left 7 and right 8 side profiles (vertical profiles of the panel 2) are positioned at the edges of the sheet 4 where the adhesive material C has been spread.

[0047] As well shown in figures 4 and 5, the profiles 7-10 have a substantially T-shaped cross section and this allows obtaining a good shape coupling with the glass sheets 4 and 5. In fact, when the sheet 4 is glued to the profiles 7-10, the edges of the sheet complementarily abut against the sides 11 of the profiles, and in such a way that the surfaces of the sheet 4 and the profiles 7-10 remain flush.

[0048] Alternatively, as schematically indicated by the dashed line 12 in figure 4, the vertical profiles 7 and 8 can also have a rounded cross section.

[0049] At this point another adhesive layer C is spread at the profiles 7-10 already coupled to the sheet 4, and the second glass sheet 5 is positioned on the profiles 7-10, care being taken to apply pressure.

[0050] The panel 2 takes thus the shape shown in figures.

[0051] At this point, cold UV light lamps are turned on, that cause the adhesive C on the glass sheets 4 and 5 and the profiles 7-10 to polymerize. The adhesive C hardens simultaneously on all the panel sides, thus completing the assembly without the use of heat sources being required.

[0052] The adhesive C also has the sealing function for the double glazing 6, meaning that, besides bonding the glass sheets 4, 5 and the profiles 7-10, it ensures the seal and, thus, the air or gas confinement in the chamber 6.

[0053] An adhesive material suitable for this purpose is commercialized by the Loxeal Company with the code *UV3021*; it is a methacrylic urethane adhesive.

[0054] Thanks to the fact that also at least the profiles 7-8 are transparent, as well as the glass sheets 4, 5, the panel 2 has greatly pleasant aesthetic. The observer gets the impression that the panel 2 is free from any frame, in contrast with the impression given by conventional panels made with not-transparent metal profiles.

[0055] Substantially the profiles 7-10 do define a frame but this is partially, or completely, also transparent as the glass sheets.

[0056] Referring specifically to figure 5, the top 9 and bottom 10 profiles each have an inner seat 13 for housing dehydrating salts, i.e. humidity absorbing salts. Salt presence minimizes the risk of condensation to be produced in the double glazing 6.

[0057] One of the advantages of making the profiles 9, 10 by extrusion is just that the seat 13 can be easily done simultaneously with the extrusion, i.e. the seat 13 can be done without material removal. Therefore, preferably, the seats 13 extend for the whole length of the profiles 9, 10.

[0058] As also shown in figure 5, the top 9 and bottom 10 profiles are provided with a further seat 14 extending parallel to the salt containing seat 13.

[0059] In each seat 14 a metal bar 15 is inserted with no, or minimum, clearance, having the function of providing an effective anchoring point for the fitting (not shown) intended for supporting the panel 2 as a door.

[0060] In the drawings, the bars 15 are not to scale. Preferably the bars 15 are battens i.e. they are flat; for example, they have a thickness of about 3 mm.

[0061] In figure 2 with the numeral reference 17 the holes pierced through the profile 9 for the insertion of

screws anchoring to the bar 15 are denoted. In other words, the brackets and the screws used for making the hinges on which the panel 2 has to rotate, are fixed to the bars 15. The holes 17 are also present at the bottom profile 10.

[0062] In addition to this just described function, the bars have the further function of reinforcing the panel 2 and reducing the risks it can break due to excessive flexing or twisting of the glass sheets 4, 5 caused in its turn by an improper use by the user. More in detail, even if the user opened the fridge door 1 with excessive strength, i.e. violently pushed the panel 2 up to the stop, the same panel would be less at risk of breakage with respect to what can be easily found now with the solutions conventionally available on the market. Flexing and/or twisting forces produced due to the violent deceleration of the panel 2 at the stop, when the hinges can not rotate further, are largely absorbed by the metal bars 15 to whom the hinges are connected.

[0063] In other words, the bars 15 inserted in the seats 14 also act as limiters of the wraps the panel 2 would be subjected to by violently impacting an obstacle or getting quickly to the stop. The Applicant found that the proposed solution greatly reduces the risk of breakage of the fridge doors, with respect to conventional solutions free from bars 15.

[0064] Preferably the bars 15, which can also be defined as "tension bars", are perforated, i.e. have a series of through holes along all the respective extent. In addition to reduce the weight, the holes (not shown) make more flexible the bars 15.

[0065] If needed, in the seats 14 pegs can be inserted, i.e. adapter elements to compensate for or cancel clearances with the bars 15.

[0066] If appropriate, the seats 13 and 14 are closed by plugs 16 (fig. 3), for example extruded or moulded plugs. The plugs 16 can also be angular plugs.

[0067] The skilled person in the art will understand that, in general, the panel 2 can also be made with no seats 13, the latter being preferred but optional.

[0068] In the example shown in figures 1-5, the number of glass sheets is two. In general, however, the panel 2 according to the present invention can be made with a larger number of glass sheets, for example three, with double glazing 6.

[0069] The skilled person in the art will further understand that the frame 3 could not only be done of transparent profiles 7-10. For example, one of the profiles, the bottom one 10 and/or the top one 9, could be made of metal or plastic but matt, otherwise they can be coated with an adhesive concealing the bars 15.

[0070] If the panel 2 was made with two chambers 6 and three glass sheets, the profiles 7-10 would have different shape, for example a substantially double-T-shaped cross section, such that a single profile can be used for joining all the three glass sheets, i.e. each profile is shared for constraining all the glass sheets.

Claims

1. A double-glazing panel (2) comprising two or more glass sheets (4, 5) and a perimetrical frame (3), wherein the glass sheets (4, 5) are supported parallel to one another only by the frame (3), and wherein between the two adjacent glass sheets (4, 5), a chamber (6) containing air or gas is defined, which is sealingly isolated from the outside by the same glass sheets (4, 5) and the frame (3), and wherein the frame (3) consists of one or more profiles (7-10) glued to the glass sheets (4, 5), **characterized in that** at least one of said profiles (7-10) is transparent.

2. Panel (2) according to claim 1, wherein the glass sheets (4, 5) are rectangular or square and the profiles (7-10) are four, a left vertical profile (7), a right vertical profile (8), a top horizontal profile (9) and a bottom horizontal profile (10), and wherein each of the profiles (7-10) is glued to at least two glass sheets (4, 5), or to all the glass sheets (4, 5), at the respective edges.

3. Panel (2) according to claim 1 or claim 2, wherein the profiles (7-10) are made of a plastic material, for example polycarbonate.

4. Panel (2) according to any one of claims 1-3, wherein the profiles are extruded or moulded.

5. Panel (2) according to any one of preceding claims 1-4, wherein the cross section of the profiles (7-10) are T-shaped and the glass sheets (4, 5) are glued to the profiles (7-10) at the longitudinal portion of the T shape, at opposite sides.

6. Panel (2) according to claim 5, wherein the glass sheets (4, 5) are glued to the profiles (7-10) at the longitudinal portion of the T shape, at opposite sides, and are flush with the transversal portion of the T shape.

7. Panel (2) according to any one of claims 1-6, wherein the glass sheets (4, 5) and the profiles (7-10) are glued so that to be flush with one another, with no undercuts.

8. Panel (2) according to any one of claims 1-7, wherein the glass sheets (4, 5) are glued to the profiles (7-10) by means of a transparent glue acting also as a sealant of the chamber (6).

9. Panel (2) according to claim 8, wherein the glue is methacrylic urethane glue.

10. Panel (2) according to any one of claims 1-9, wherein at least one of the profiles comprises a first inner

seat (13) in which dehydrating salts are housed.

11. Panel (2) according to any one of claims 1-10, wherein at least one of the profiles comprises a second inner seat (14), in which a bar (15) is housed and has the double function of:

- being an element to which the hinges can be anchored for the use of the panel (2) as door or window;
- being a limiting element to limit the deformations the panel (2) is subjected to, in case of violent or quick impacts at the stop.

12. Panel (2) according to claim 11, wherein the bars (15) extend for the whole length of the edge of the respective glass sheets (4, 5).

13. Panel (2) according to claim 11 or claim 12, wherein the bars (15) are perforated, with through holes or slots, in order to improve the elastic behavior of the bars.

14. Panel (2) according to any one of claims 11-13, wherein the bars (15) are flat battens.

15. A method for making a double-glazing panel (2) for the use as door or window, comprising:

a) extruding or moulding one or more profiles (7-10) made of a transparent plastic material;
b) gluing, with transparent glue, at least two glass sheets (4, 5) to the profiles (7-10), at the edges of the glass sheets (4, 5), so that the profiles remain interposed between the parallel glass sheets (4, 5), and between the latter, a chamber (6) containing air or gas is defined;
c) causing the solidification of the glue (C) and isolating the chamber (6) between the glass sheets (4, 5) and the profiles (7-10).

16. Method according to claim 15, wherein step b) is carried out with methacrylic urethane glue and step c) is carried out by illuminating the glue with cold ultraviolet light.

17. A double glazing panel (2) comprising two or more glass sheets (4, 5) and a perimetrical frame (3),
wherein the glass sheets (4, 5) are supported parallel to one another only by the frame (3), and
wherein between the two adjacent glass sheets (4, 5), a chamber (6) containing air or gas is defined, which is sealingly isolated from the outside by the same glass sheets (4, 5) and the frame (3), and
wherein the frame (3) consists of one or more profiles (7-10) glued to the glass sheets (4, 5),
characterized in that
at least one of the profiles comprises an inner seat (14), in which a bar (15) is housed having the double function of:

- being an element to which the hinges can be anchored for the use of the panel (2) as door or window;
- being a limiting element to limit the warps the panel (2) is subjected to, in case of violent or quick impacts at the stop.

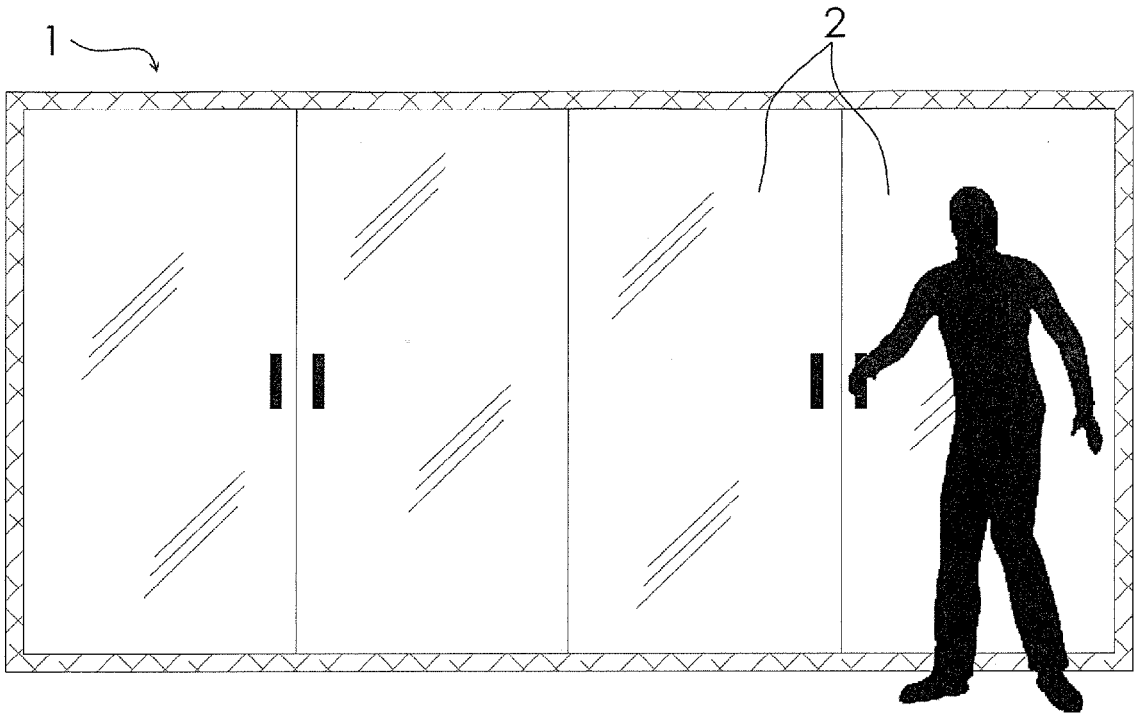

Fig. 1

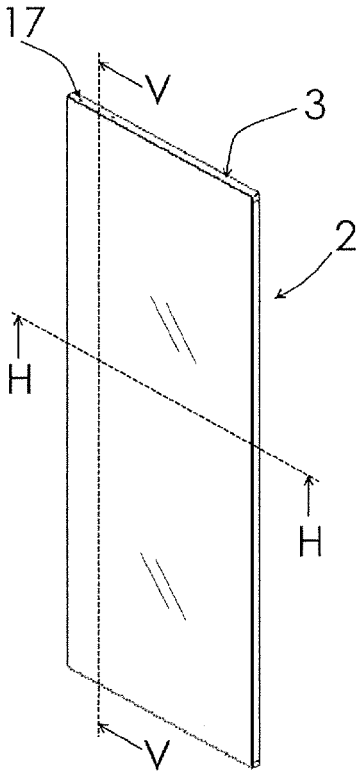

Fig. 2

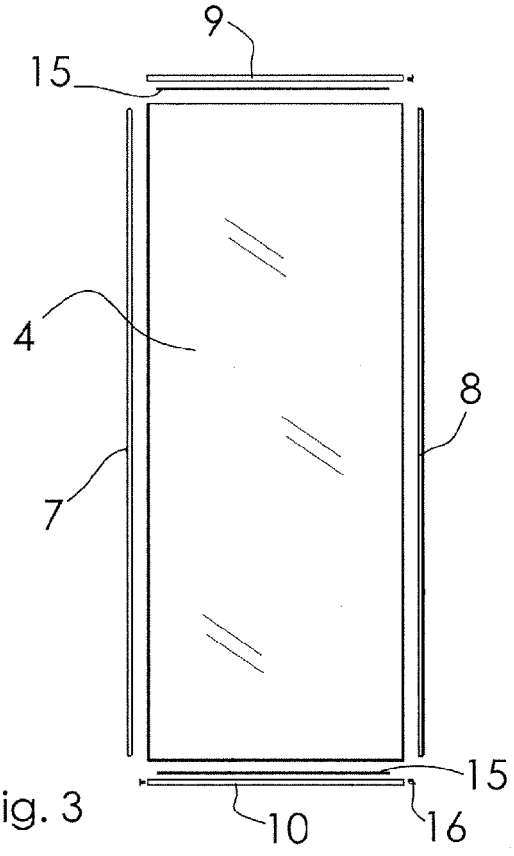

Fig. 3

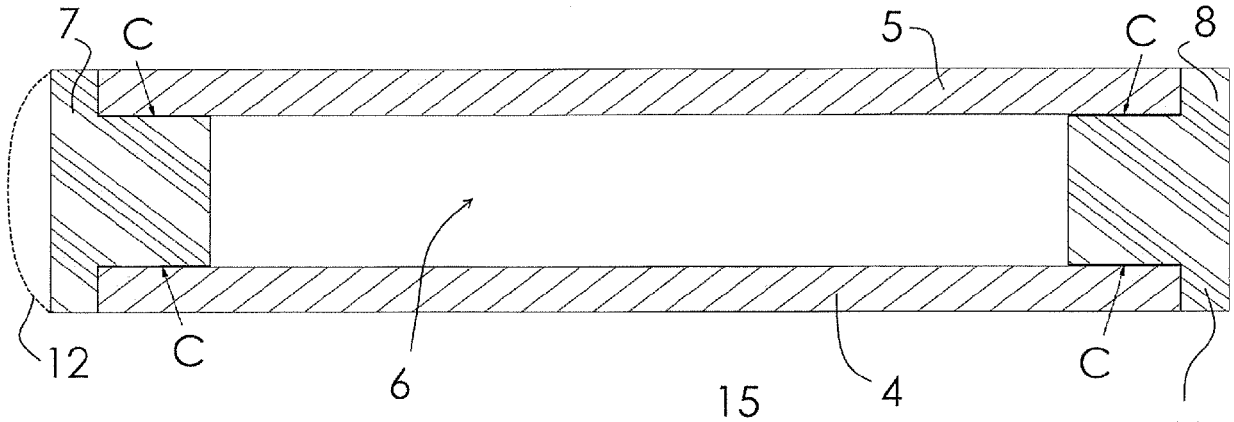

Fig. 4

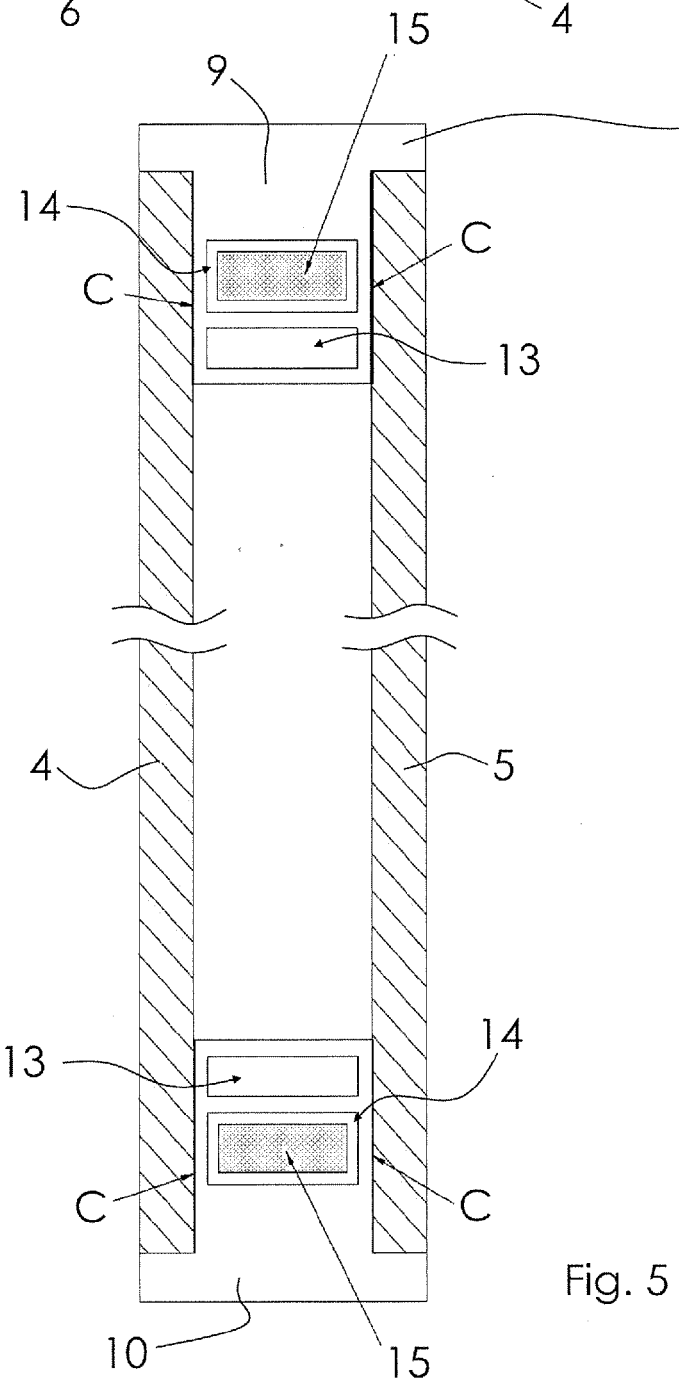

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 17 17 9030

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	WO 2014/198549 A1 (AGC GLASS EUROPE [BE]) 18 December 2014 (2014-12-18) * page 6, line 25 - page 7, line 2; figures 1,2 *	1-4, 7-10,15, 16 11-14	INV. E06B3/663
X	DE 20 2012 013218 U1 (REMIS GES FÜR ENTWICKLUNG UND VERTRIEB VON TECH ELEMENTEN MBH [DE]) 25 June 2015 (2015-06-25) * paragraphs [0009] - [0011], [0014]; claim 1; figure 2 *	1-6, 8-10,15, 16	
X	US 2017/016271 A1 (BOUCHER NICOLAS [BE] ET AL) 19 January 2017 (2017-01-19) * paragraph [0041]; figures 3,3a *	1-4,7-10	
X	WO 2010/119067 A1 (BERESFORD GARY PAUL [GB]; SULLIVAN MICHAEL WILLIAM [ES]) 21 October 2010 (2010-10-21) * claim 1; figure 4 *	1,2,4, 7-10	
			TECHNICAL FIELDS SEARCHED (IPC)
X Y	DE 102 11 940 A1 (TEGRALIS GMBH [DE]) 2 October 2003 (2003-10-02) * figure 4 *	17 11-14	E06B
E	WO 2017/174333 A1 (SAINT-GOBAIN GLASS FRANCE [FR]) 12 October 2017 (2017-10-12) * claims 1,2 *	1	
E	WO 2017/157634 A1 (SAINT GOBAIN [FR]) 21 September 2017 (2017-09-21) * page 5, line 30 - page 6, line 2 *	1	
E	WO 2017/157637 A1 (SAINT GOBAIN [FR]) 21 September 2017 (2017-09-21) * abstract *	1	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 January 2018	Verdonck, Benoit

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
E	WO 2017/157636 A1 (SAINT GOBAIN [FR]) 21 September 2017 (2017-09-21) * abstract * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

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