(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 450 518 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.05.2012 Bulletin 2012/19

(51) Int Cl.:
E06B 3/70 *(2006.01)*

(21) Application number: **11187883.1**

(22) Date of filing: **04.11.2011**

(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: **04.11.2010 DK 201001000**

(71) Applicant: **CT Doors ApS**
7400 Herning (DK)

(72) Inventor: **Henriksen, Bjarne**
7400 Herning (DK)

(74) Representative: **Tellefsen, Jens J. et al**
Patrade A/S
Fredens Torv 3A
8000 Aarhus C (DK)

(54) **Composite door**

(57) Door construction comprising a core plate substantially having outer dimensions corresponding to the finished door, where the core plate has a front and rear face, delimited by a number of side faces, which core plate is provided with a loose metallic cover plate on the face of the door intended to be facing the outside, where said loose plate is arranged in grooves provided in three of the side faces of the core plate.

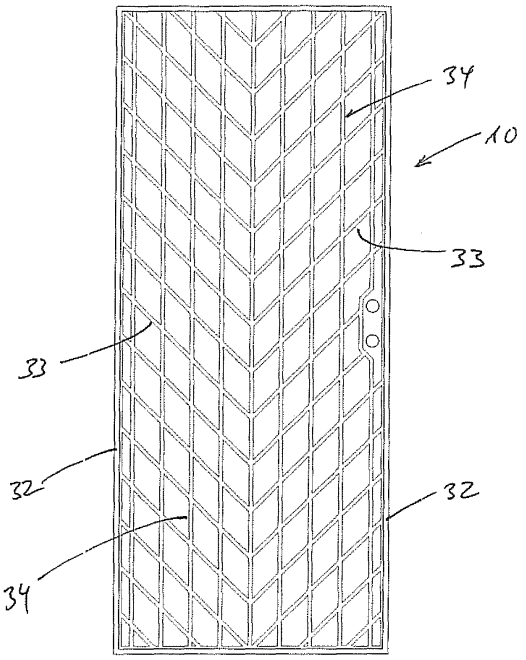

Fig. 9

EP 2 450 518 A2

Description

Field of the Invention

[0001] The present invention relates to a door construction comprising a core plate where said core plate on the side of the door which is intended to be exposed to the outside is provided with a metallic cover plate.

Background of the Invention

[0002] In the art it is well-known to produce windows where the frame part of the window, i.e. the frame surrounding the glass and the frame which is to be fastened to the building are made from a combination of wood and a metallic or composite outer cladding as for example an aluminium or GRC plate, painted in the desired colour.

[0003] One problem associated with this construction is the fact that the aluminium plate and most other metallic plates have different material characteristics from the timber construction such that as the timber expands/contracts due to changes in moisture, temperature etc. the aluminium will move in a different manner. This creates a tension between the two different materials whereby special assembly details are required in order to create a coherent construction utilizing different materials. In the art a plurality of manufactures have overcome this problem as long as the physical size, for example the width of the frame and the length of the frame are within limits such that it is possible to control the different relative material parameters in a manner where the window construction does not tear itself apart.

[0004] One of the main advantages of being able to provide an outer skin of for example an aluminium cover plate is the fact that these are very low on maintenance and have a very long life expectancy whereas the traditional timber windows need to be repainted at regular intervals and furthermore they may be attacked by fungus, rot and the like.

[0005] For users there is therefore a substantial advantage connected with using windows with low maintenance and long life expectancy.

[0006] It has, however, until now not been possible to provide a door with the same advantages due to the size and construction of the door. In this connection a door shall be construed as being substantially massive doors, typically having a wood frame where the front and rear sides are covered by some kind of wood-based material, for example so-called MDF-plates, and between the frame and the plates is provided a core material, for example a foam or a cellular structure, in order to provide rigidity and stability and possibly insulation characteristics for the door. In this type of doors a small window may be installed.

Object of the Invention

[0007] The invention addresses this need by providing a door construction comprising a core plate substantially having outer dimensions corresponding to the finished door, where the core plate has a front and rear face, delimited by a number of side faces, which core plate is provided with a loose metallic cover plate on the face of the door intended to be facing the outside, where said loose plate is arranged in grooves provided in three of the side faces of the core plate.

[0008] The fact that the cover plate is substantially loose allows the plate to expand/contract without engaging the core plate arranged behind the cover plate. Therefore no tension and thereby no deformation will be present in the cover plate, and as such the door will remain undisturbed due to the influence of the ambient environment. The grooves provided in three of the side faces of the core plate shall naturally have a size first of all accommodating the cover plate thickness and secondly allowing the cover plate to move in response to the environmental impact. On the other hand, the grooves shall not have a size such that the cover plate will be able to "rattle" relative to the core plate.

[0009] A further advantage of providing the door with a metallic plate, for example of the same type as used with the window frames, is that the building obtains a more homogenous look, in that the surface coating, both with respect to shine/gloss and colour nuance of the doors will be identical to that of the windows.

[0010] In a further advantageous embodiment of the invention the grooves are arranged in a top side face, and two vertical side faces, in the use situation, and that fastening means are provided connecting a portion of the top face to the metallic cover plate.

[0011] In this connection the fastening means may for example be a single screw connecting a top part of the metallic cover plate to a top part of the core plate such that physically they are connected in one point, but apart from that the cover plate is completely free to move relative to the core plate only limited by the cover plate's insertion in the grooves in the side faces of the core plate.

[0012] In a still further advantageous embodiment the core plate on its front face is provided with a plurality of primary channels, where said primary channels are arranged at an angle different from 90° relative to the side faces, and optionally a number of vertical secondary channels is provided where said vertical channels interconnects a number of the primary channels, and where said secondary channels extend to the bottom side face of the core plate.

[0013] The channels serve a number of purposes, but the main purpose is to provide ventilation between the cover plate and the core plate. By providing ventilation the temperature difference across the cover plate will be as small as possible and as such buckling or other undesirable phenomena may be avoided. Furthermore, the ventilation will also ensure that humidity will not build up between the core plate and the cover plate. This is important in that the core plate is also exposed to severe influences in that inside the building the temperature may

be 20 or 22°C and the relative humidity may be 40-80% RH whereas on the outside at the same time the temperature might be -10°C and the relative humidity 100%. Consequently, the core plate is exposed to dramatic environmental influences. By ensuring that there is no moisture build-up on one side of the core plate by providing the channels in the front face of the core plate the influence of "artificial" moisture build-up due to the provision of the cover plate is avoided whereby the impact on the core plate is lessened.

[0014] A second purpose of the channels is to drain away any water which anyhow may enter into the space between the cover plate and the core plate's front face whereby the channels will lead any water trapped between the core and the cover plate, influenced by gravity to travel towards the secondary channels and consequently run out through the space between the cover plate and the core plate at the bottom of the door. Although the cover plate is arranged in grooves along a substantial part of the periphery of the core plate the play in the grooves between the cover plate and the core plate may give rise to water ingression into the space between the cover plate and the core plate. Such a situation may arise especially in very windy conditions with rain or snow and the door construction according to the invention in this manner foresees that it is possible to drain off any water.

[0015] In a still further advantageous embodiment of the invention the metallic cover plate is made from aluminium and has a thickness between 1 mm and 1.8 mm, most preferred 1.5 mm, and that the grooves in the core plate are between 1.2 and 2.5 mm wide, most preferred 2 mm wide and 5 mm and 15 mm deep, most preferred 8.5 mm deep.

[0016] Naturally, the dimension shall be seen in the light of the overall dimensions of the door, but for normal door types used for housing and the like, these dimensions have proven to provide the advantages as already discussed above.

[0017] The inventive construction according to the invention is used regardless of the thickness of the door as such. The cover plate only requires a very limited thickness in order to provide room for the grooves, optionally in the side faces. As the requirements to insulating properties of construction elements, and also doors steadily increases the present system is adaptable to any door thickness. At present doors having a thickness from 40 mm upwards are used as "standard doors". A standard door will typically be between 1900 and 2350 mm high and 900mm to 1300 mm wide. The door size limitations are normally due to loads on hinges and the surrounding construction, but the present invention is also to be used with much larger doors.

[0018] The relative size of the grooves with respect to the thickness of the cover plate is such that it is possible for the cover plate to move slightly in the grooves, as explained above, without allowing the cover plate to be loose, i.e. be affected by wind or the like such that unwanted noises, rattling and the like may occur due to especially too wide grooves. The grooves are furthermore deeper than the section of the cover plate inserted into the grooves. In this manner it is possible to allow the door to work with the environment such that when it is warm, i.e. the door is for example exposed to sunlight, the door plate will be able to expand and thereby move in the grooves without affecting the underlying core plate.

[0019] In the same manner, when it is cold the cover plate will be able to contract without affecting the core plate itself. In this manner it is ensured that the cover plate is not deformed due to environmental influences and as such a long lasting door construction is provided.

[0020] This aspect, that the door is "self-thinking" is also an important aspect. In cold weather when it is most likely that the door will be exposed to moisture (rain, sleet and the like) the cover plate will contract, due to low temperature, and thereby close off the space between the core and cover plates, whereas when it is warmer the cover plate will expand and allow more air circulation and thereby drying of the construction.

[0021] In a further advantageous embodiment of the invention the cover plate is provided with a bent section along three edges, where said bent section comprises a first part bent approx. 90° relative to the cover plate and a second part bent approx. 90° relative to the first part, such that the second part is substantially parallel to the front of the cover plate, and that the first part is the cover plate's side, where the interior dimension between the bent sections along the cover plate's sides is 1 to 4 mm larger than the width of the core plate.

[0022] With this advantageous embodiment the cover plate will also cover the outermost edges of the core plate, and as such will provide a much better aesthetic presentation in that the cover plate will appear to be completely integrated in the entire door plate. The bent sections will naturally limit the movement of the cover plate relative to the core plate, and it is therefore important that the dimensions measured internally between two internal side faces of the core plate from side to side of the core plate are adequate in order to take up the thermal movements as discussed above. For these reasons the interior dimension between bent sections along the cover plate sides is to be between 1 and 4 mm larger than the width of the core plate in order to be able to take up any thermal expansion/contraction of the cover plate relative to the core plate. It is to be understood that for larger surfaces the extent of the oversize, i.e. the 1 to 4 mm, should be increased, but for normal door sizes it has been found to be adequate to provide 1 to 4 mm extra space.

[0023] In a still further advantageous embodiment a window is fitted into the door construction, where an aperture is provided in the cover plate, corresponding to the window's dimension, where a friction reducing layer is provided between the glass of said window and the inner side of the cover plate.

[0024] In order to allow the cover plate to move relative to the window which is also fixed in the core plate it is

necessary to provide a flexible layer or even a friction reducing layer between the cover plate and the window.

[0025] In a still further advantageous embodiment of the invention the core plate at least on the front side as outermost coating is provided with a coating of a fungicide.

[0026] Although it is the intention that the channels provided in the front side of the core plate shall provide adequate ventilation and drainage such that a relatively dry environment is present between the cover plate and the core plate, the core plate is in this embodiment provided with a fungicide such that any fungus or other biological matter is deterred from growing between the cover plate and the core plate.

[0027] The core plate may also or alternatively be provided with a fire retarding/retardant core or a sound absorbing core. In this manner the door will be suitable for example as a fire door or as a sound proofing door.

Description of the Drawing

[0028] The invention will now be described with reference to the accompanying drawing wherein

Figure 1	illustrates a cross section through an outwardly opening door;
Figure 2	illustrates a detailed view of the top of the door in fig 1;
Figure 3	illustrates a similar detail of the door in fig 1;
Figure 4	illustrates a similar detail of the door in fig 1;
Figure 5 -8	illustrate details comparable to fig 1-4, however for an inwardly opening door;
Figure 9	illustrates the front face of the core plate
Figure 10	illustrates a cross section through a door with window

Detailed Description of the Invention

[0029] In the art of doors and windows there are generally two types, i.e. windows and doors which open outwards in relation to the building, and windows and doors which open inwards relative to the building. The direction of opening has great influence on the details relating to the interface between the openable part, i.e. the window or the door, and the frame mounted in the building in that the details of this interface has to take into account where to place weather strips etc. in order to provide a weather-tight seal between the openable part and the fixed part and at the same time take into account insulation properties relating to the joint between the openable part and the fixed part. Consequently, in figures 1-4 details relating to a door opening outwards with respect to the frame are illustrated, and similarly, in figures 5-8 details relating to a door opening inwards with respect to the frame are illustrated. In the detailed description below reference will only be made to figures 1-4 although identical reference numbers are used in figures 5-8 as the details relating to the present invention are irrelevant with respect to the details relating to whether or not the door is inwardly or outwardly openable.

[0030] Turning to figure 1 a cross section through a door 1 according to the invention is illustrated. The door 1 comprises a core plate 10 and a metallic cover plate 20.

[0031] The core plate 10 comprises a relatively rigid and hard frame 11 which is present along all the side faces of the core plate 10. The front and rear face 12, 13 are covered by a plate material such that core material 14 is enclosed in the core plate 10.

[0032] Due to differences in vapour pressure on the inside and outside of the door, thin (0,3 mm) aluminium foils are or may be provided on either side of the core material 14. In this manner build up of moisture inside the door construction, and particularly in the core material is avoided. The vapour difference would otherwise force potential moist air into the door construction, but by providing a vapour tight barrier this is avoided.

[0033] The core material 14 may typically be an insulating material or a honeycomb web giving stability and strength and insulation properties to the core plate 10 as such.

[0034] The profiling of the frame 11 is provided in order to provide seats for weather-strips corresponding to the closing details when the door is closed against the frame such that a weather-proof and heat insulating closure may be provided.

[0035] At the rear side of the core plates 12, 13, i.e. facing the core material 14, may be provided a thin aluminium film that will prevent the ingress of moisture into the construction of the core plate as such.

[0036] The cover plate 20 is, as is evident from the cross section in figure 1 provided with a bent section 21 where the bent section comprises a first part 22 and a second part 23. Each part is bent approximately 90° relative to the prior part. In this manner the second part 23 will be arranged substantially parallel to the front face of the cover plate 20. By providing a groove 15 in the top side 11 the bent section 21 may be accommodated on the core plate in a manner such that the face of the cover plate 20 will follow the front face of the core plate 10 as illustrated in figure 1.

[0037] At the bottom of the door the core plate 10 is provided with a recess 16 such that any water flowing down the cover plate 20 will be able to drip off the bottom part of the cover plate 20. In other embodiments the lower part of the door may be provided with a protective plate which is glued to the front face of the cover plate 20 in order to protect the cover plate 20 from mechanical impacts from kicking, scratching and the like. In the same construction a drip-nose may be provided which will effectively make sure that rain, etc. is guided safely away from the door construction 1 as such. The protective plate as well as the drip-nose system may be adhesively connected to the cover plate 20.

[0038] Returning to the groove 15 it is important that

the groove 15 is deeper than the second bent portion 23 whereby it is ensured that the cover plate is free to expand/contract and furthermore assure that especially the first bent part 22 rests against the uppermost side face of the core plate 10. Typically, the cover plate 20 will be fastened by means of a single screw through the first bent portion 21 screwed into the upper part of the core plate 10.

[0039] Figure 2 illustrates a detailed view of the top of the door where it is evident that the groove 15 is larger both depth-wise and width-wise than the second bent portion 23. This aspect is rather important in that it allows the cover plate 20 to move relative to the core plate 10 such that any unintended bending, buckling or the like of the cover plate is avoided due to thermal-expansion/contraction or the influence of moisture.

[0040] In figure 3 is illustrated a similar detail although it is the cover plate's connection to a side face 10 a of the core plate 10. Again, the dimensions of the groove 15 are selected such that it is slightly larger than the material thickness and length of the second bent portion 23 allowing movement between the core plate 10 and the cover plate 20.

[0041] Turning to figure 4 a horizontal cross-section through a door 1 according to the invention is illustrated.

[0042] Again, it is evident that the cover plate 20 is provided with bent sections 21 along both side faces 10a, 10b of the core plate 10 such that the bent sections 21 may be accommodated in grooves 15 provided in said side surfaces 10a, 10b. Furthermore, it is evident that channels 31 are provided in the cover plate 12 along the core plate's front face. These channels will be further elaborated with reference to figure 9. A special channel 32 is provided along the outer sides of the core plate 10 providing a relatively free space for the bent sections 21 to move in and to drain off any water which may be forced in between the backside of the cover plate 20 and the core plate 10 due to the enlarged sizes of the grooves relative to the thickness of the cover plate.

[0043] Fig. 5 to 8 illustrate the corresponding features with respect to a door which opens inwards.

[0044] In figure 9 is illustrated the front face of the core plate 10. In the front face are arranged primary channels 33 as well as secondary channels 34. Furthermore, a half channel 32 is provided adjacent the sides of the core plate 10.

[0045] The channels 32, 33, 34 serve to drain water and moisture away from the space between the core plate 10 and the cover plate 20 (not illustrated). Furthermore, by creating the lattice work of channels 32, 33, 34 good ventilation is ensured in this space between the core plate 10 and cover plate 20.

[0046] In some embodiments the half channels 32 along the vertical side edges of the door continues through the cover plate, i.e. apertures are provided. In these embodiments the ventilation inside the door is greatly improved.

[0047] Turning to figure 10 a cross section through a door 1 according to the invention in which a window is mounted is illustrated. Typically windows in these types of doors are relatively small compared to the overall area of the door.

[0048] The cover plate 20 is in this embodiment provided with a profiling 25, but otherwise the cover plate is as illustrated in the examples mentioned above. In the core plate 10 is provided an aperture 16 into which a window 40 is fitted. In this embodiment the window comprises three glass layers 41 a, b, c, each layer separated by a gas-filled space. The window 40 is kept in place by an interior frame 42 which by means of screws 43 is fixed to the core plate 10. In this embodiment a sash bar 44 is furthermore provided according to the desired design. Between the frame 42, the sash bar 44 and the glass 41 c is provided a double-adhesive strip 45. This adhesive strip fixes the glass to the frame 42 and the sash bar 44 such that a firm connection is created between the window 40 and the core plate 10. In the same manner the cover plate 20 is fastened to the core plate 10 and the glass 41 a by means of a double-sided adhesive strip 46.

[0049] In order to provide weather-proof ness, especially resistance against water, a joint filler 48 is provided as a top sealing of the connection between the cover plate and the glass, in order to protect especially the double-adhesive strip.

[0050] Windows of various sizes and configurations as well as other elements such as grips, spy-holes etc. may be fitted in a similar manner.

[0051] The metallic cover plate is described above as being aluminium. It is naturally contemplated that other metallic materials, such as for example zinc, copper, stainless steel, steel and the like may be used with the present invention without departing from the inventive scope. Furthermore the cover plate may be provided with a surface coating, relief, embossing or other profiling or design, which does also not have influence on the inventive characteristics of the present invention.

Claims

1. Door construction comprising a core plate substantially having outer dimensions corresponding to the finished door, where the core plate has a front and rear face, delimited by a number of side faces, which core plate is provided with a loose metallic cover plate on the face of the door intended to be facing the outside, where said loose plate is arranged in grooves provided in three of the side faces of the core plate.

2. Door construction according to claim 1 **characterised in that** the grooves are arranged in a top side face, and two vertical side faces, in the use situation, and that fastening means are provided connecting a portion of the top face to the metallic cover plate.

3. Door construction according to claim 1 **characterised in that** the core plate on its front face is provided with a plurality of primary channels, where said primary channels are arranged at an angle different from 90° relative to the side faces, and optionally a number of vertical secondary channels is provided where said vertical channels interconnects a number of the primary channels, and where said secondary channels extend to the bottom side face of the core plate.

4. Door construction according to claim 1 **characterised in that** the metallic cover plate is made from aluminium and has a thickness between 1 mm and 1.8 mm, most preferred 1.5 mm, and that the grooves in the core plate are between 1.2 and 2.5 mm wide, most preferred 2 mm wide and 5 mm and 15 mm deep, most preferred 8.5 mm deep.

5. Door construction according to claim 1 **characterised in that** the cover plate is provided with a bent section along three edges, where said bent section comprises a first part bent approx. 90° relative to the cover plate and a second part bent approx. 90° relative to the first part, such that the second part is substantially parallel to the front of the cover plate, and that the first part is the cover plate's side, where the interior dimension between the bent sections along the cover plate's sides is 1 to 4 mm larger than the width of the core plate.

6. Door construction according to claim 1 **characterised in that** a window is fitted in the door construction, where an aperture is provided in the cover plate, corresponding to the window's dimension, where a friction reducing layer is provided between the glass of said window and the inner side of the cover plate.

7. Door construction according to any preceding claim **characterised in that** the core plate, at least on the front side, as outermost coating is provided with a coating of a fungicide.

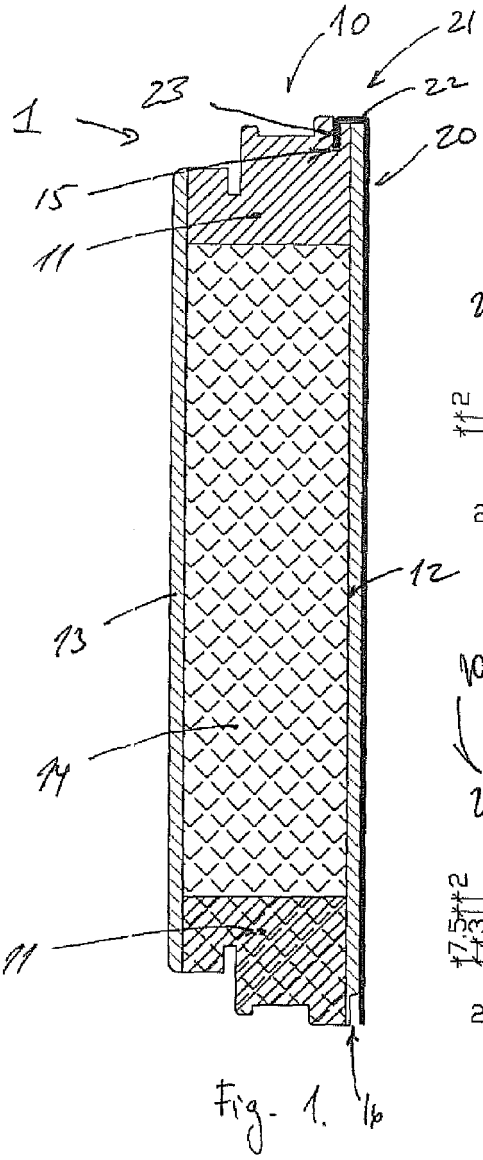

Fig. 1.

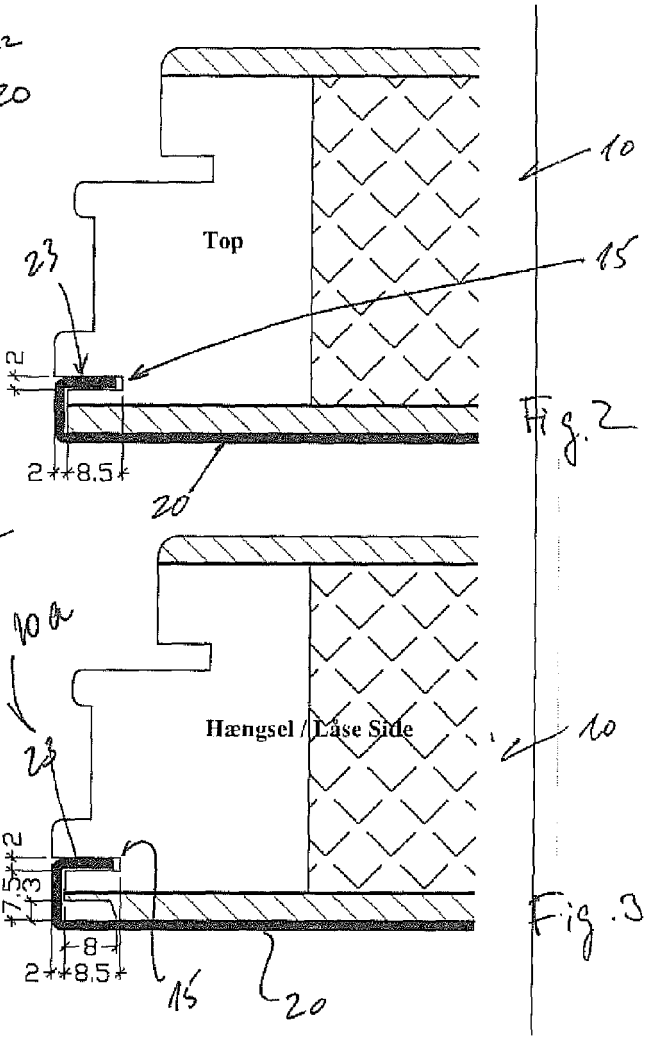

Fig. 2

Fig. 3

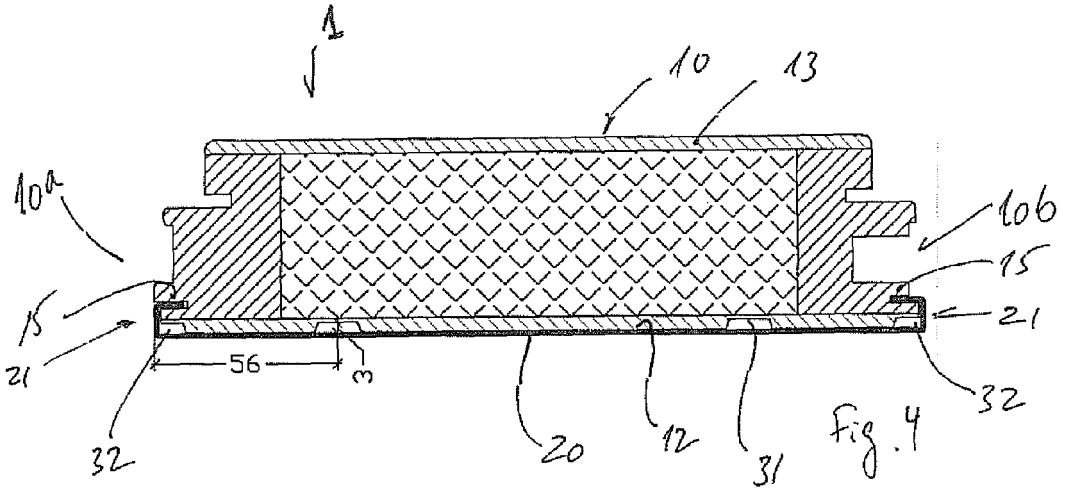

Fig. 4

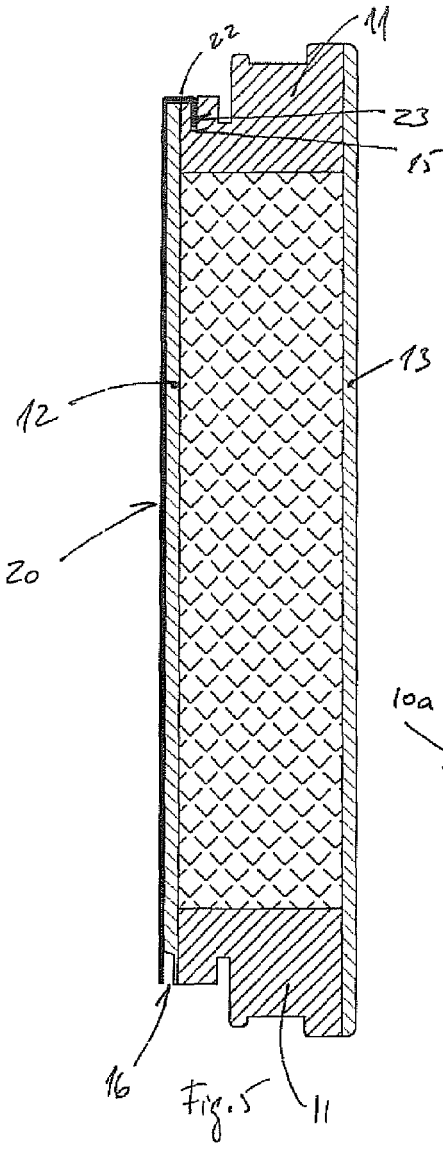

Fig.5

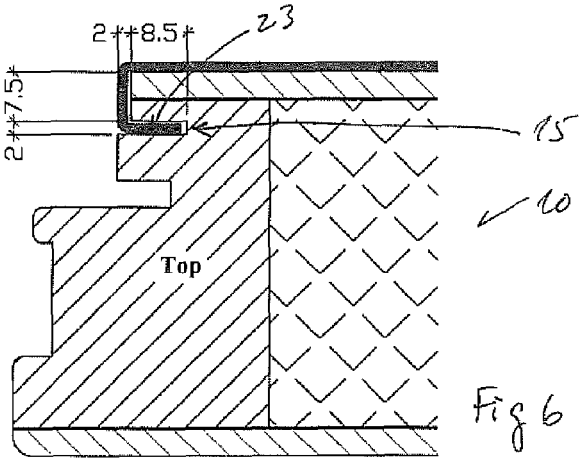

Fig 6

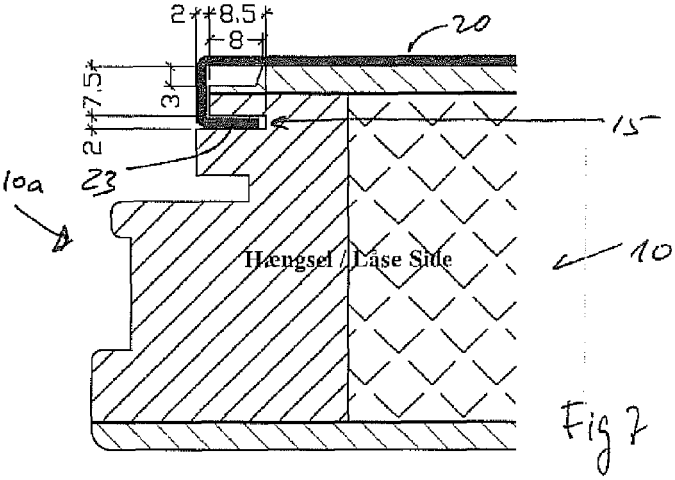

Fig 7

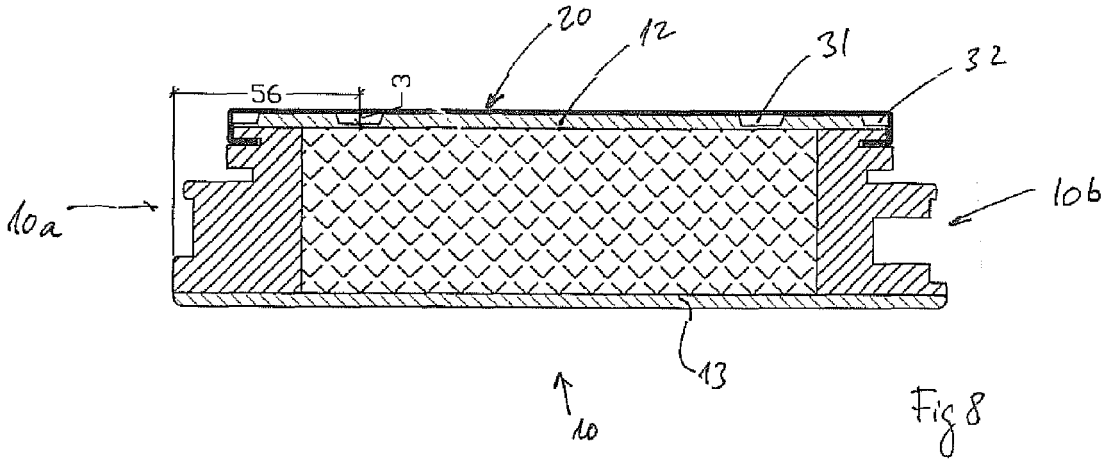

Fig 8

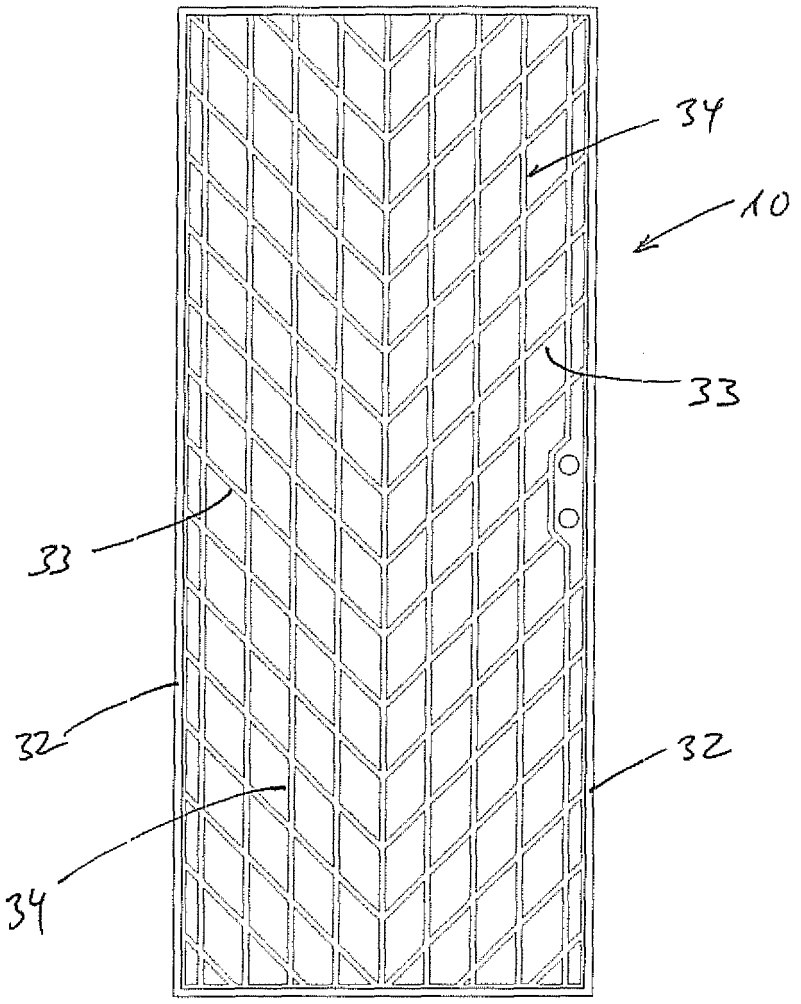

Fig. 9

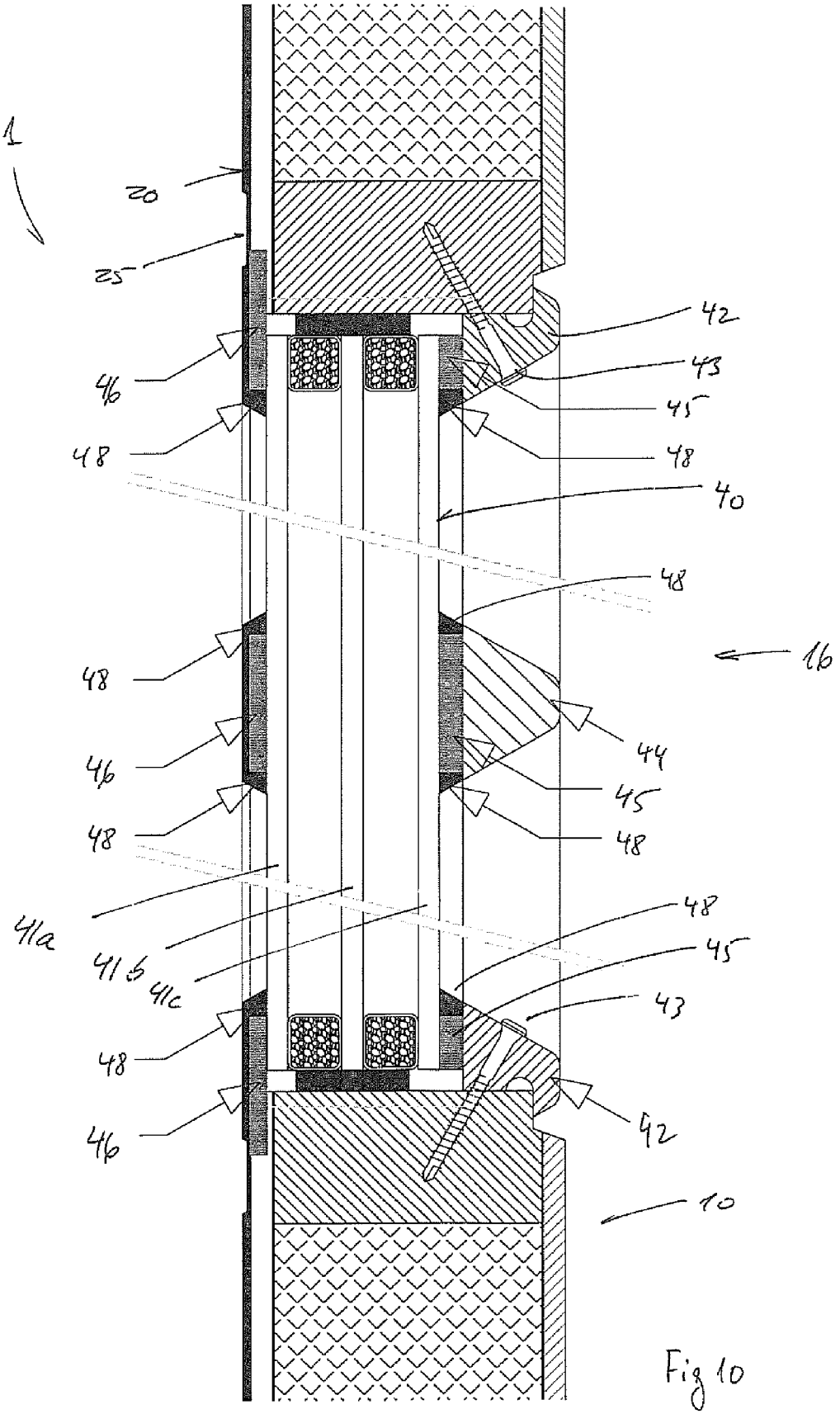

Fig 10