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

(11) **EP 3 591 160 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
08.01.2020 Bulletin 2020/02

(51) Int Cl.:
E06B 3/30 *(2006.01)* ***E06B 3/20*** *(2006.01)*
E04D 13/035 *(2006.01)*

(21) Application number: **19184756.5**

(22) Date of filing: **05.07.2019**

(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
Designated Validation States:
KH MA MD TN

(30) Priority: **06.07.2018 DK PA201870471**

(71) Applicant: **VKR Holding A/S**
2970 Hørsholm (DK)

(72) Inventors:
- **Dommert, Matthias**
  2970 Hørsholm (DK)
- **Meyer-Hansen, Michael**
  2970 Hørsholm (DK)
- **Harding, Vanessa Margaret**
  2970 Hørsholm (DK)
- **Simonsen, Sverre**
  2970 Hørsholm (DK)

(74) Representative: **AWA Denmark A/S**
Strandgade 56
1401 Copenhagen K (DK)

(54) A WINDOW FRAME ADAPTED FOR USE AS A SASH OR A STATIONARY FRAME, AND A METHOD FOR MAKING A WINDOW FRAME

(57) A window frame adapted for use as a sash or a stationary frame comprising a strengthening portion and a moulded surface layer covering the strengthening portion wholly or partially and giving the frame desired surface properties is disclosed. At least one strengthening member of the strengthening portion includes a shell defining an outer surface of the strengthening member, and a plurality of strengthening ribs and/or flanges extending from the shell. Said at least one strengthening member includes a plurality of closed cells arranged in continuation of each other in the longitudinal direction, each cell being delimited by the shell and one or more strengthening ribs and/or flanges. A method for making such a frame includes providing a strengthening portion, and covering the strengthening portion wholly or partially with a surface layer by moulding thereby giving the frame desired surface properties.

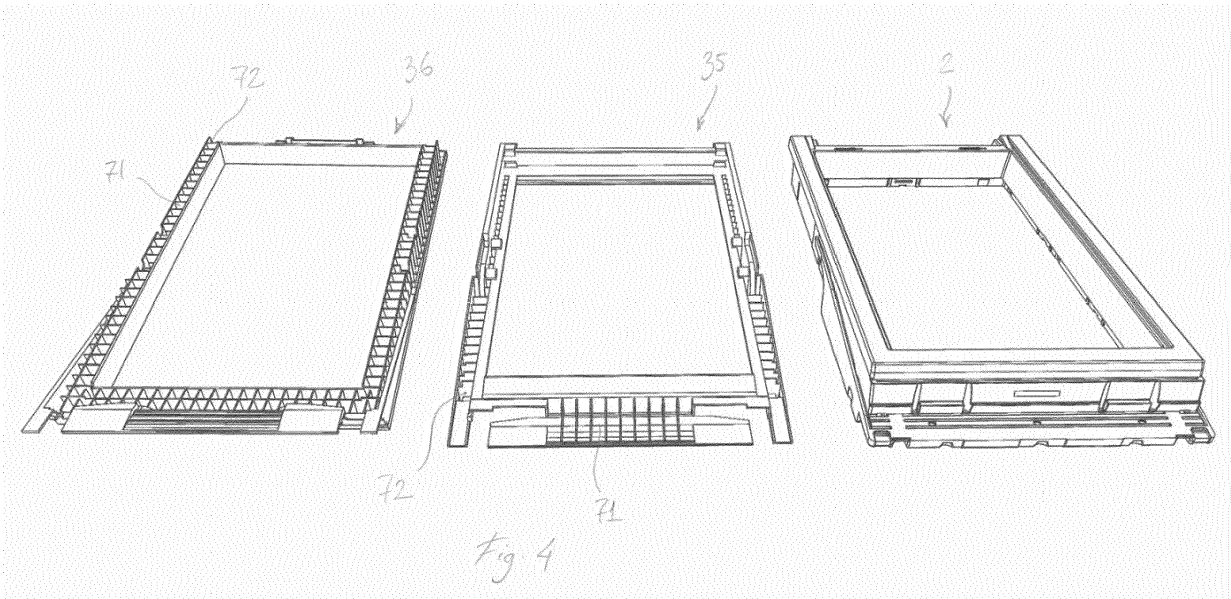


Fig. 4

EP 3 591 160 A1

Description

Technical Field

[0001] The present invention relates to a window frame adapted for use as a sash or a stationary frame, said frame including a top frame member, a bottom frame member, and two side fame members, these frame members defining a frame plane and each of these frame members having a longitudinal direction extending in the frame plane, said frame comprising a strengthening portion and a moulded surface layer covering the strengthening portion wholly or partially and giving the frame desired surface properties, where at least one strengthening member of the strengthening portion includes a shell defining an outer surface of the strengthening member, and a plurality of strengthening ribs and/or flanges extending from the shell. The invention further relates to a method for making such a frame.

Background Art

[0002] Frames with strengthening portions covered by a moulded surface layer have been used for decades in roof windows, one example being described in EP2167770A1 where the strengthening portion is made from wood-based materials and the surface layer from polyurethane (PUR). The use of wood, however, has caused some concern since material strength varies and wood requires a lot of processing.

[0003] An alternative to wood serving as a strengthening portion is extruded profiles made from metal or polymer as described for example in US2009/0094929A1. Such profiles are relatively easy and cheap to manufacture and when covered with a polymer they can be used for making frames for windows.

[0004] Building regulations are, however, becoming ever stricter when it comes to energy conservation and the demand for reducing material consumption is rising, and still further improved window frames are therefore required.

Summary of Invention

[0005] It is therefore an object of the invention to provide a window frame adapted for use as a sash or a stationary frame, which is both durable and suitable for industrial scale production, and which allows an optimisation of insulating properties and material consumption.

[0006] In a first aspect of the invention this is achieved with a frame, where said at least one strengthening member of the strengthening portion includes a plurality of closed cells arranged in continuation of each other in the longitudinal direction, each cell being delimited by the shell and one or more strengthening ribs and/or flanges.

[0007] The cells provide the strengthening portion with an optimal balance between strength and low weight as the ribs and/or flanges forming the wall delimiting the cells extend into the space defined by the shell and hence provides flexural rigidity to the frame member. The walls delimiting the cells may also extend from the shell on one side of the strengthening portion to the shell on the opposite of the strengthening portion, thereby increasing the compressive strength of the strengthening portion. Ribs and/or flanges extending from the shell may be positioned along the length of the shell. In this way, the strength of the strengthening portion is increased in the longitudinal direction extending in the frame plane.

[0008] By positioning the ribs and/or flanges appropriately the strengthening portion forms a light lattice-like load-bearing structure within the frame, where load-bearing material is mainly present where it is needed. Sections with less need for strength may further employ a thinner material thickness to save material and weight and provide less thermal conduction. A lattice-like structure includes a lattice with shapes including circles, triangular, square, rhombus, pentagon, hexagon, although any suitable shape may be used. These can be formed from overlapping or interconnecting ribs/flanges.

[0009] It is noted that the description of the strengthening portion as being made from several strengthening members is not intended to mean that it must be made from several separate members, which are interconnected for the formation of the strengthening portion. A rectangular strengthening portion may be regarded as having a top member, a bottom member, and two side members corresponding to the top frame member, the bottom frame member, and the two side fame members of the frame even if made as one unitary portion. Embodiments where separate strengthening members are interconnected are, however, presently considered advantageous as a strengthening portion may then for example be composed by combining top, bottom and side members having desired properties, including lengths, to suit the desired properties of the finished frame.

[0010] The strengthening portion may be made from any material which is not sensitive to water and which is preferably suitable for forming a lattice-like structure, including metals, but in order to reduce the formation of thermal bridges it is presently preferred that the strengthening portion is made primarily from a polymer. Materials chosen from the group consisting of polypropylene, high density polyethylene, polyethylene terephthalate, polycarbonate, acryl-nitrile-butadiene-styrene, polyamide 6, polyamide 66, polyurethane, polyvinylchloride, chlorinated polyvinylchloride, and mixtures thereof are presently preferred. Such suitable polymers generally have a density above 0.85 g/cm^3. Such suitable polymers are generally thermoplastics. The strengthening portion may comprise a polymer with a fibre filler. The filler may for example be glass fibre or a natural fibre, such as cellulose, which will provide high strength and relatively low weight.

[0011] The material should of course be chosen with a view to the compatibility with the material used for the surface layer. Recyclability can also be taken into ac-

count. The strengthening portion may include several layers of material, several different materials, and/or be provided with a surface profiling. For example, the shell may be made from a different material than the ribs and/or flanges, or the shell may include an inner layer connected to the ribs and/or flange and an outer layer suited for contact with the material used for the surface layer. The outer side of the shell may also be provided with a profiling adapted for optimizing the contact with the surface layer.

[0012] In one embodiment at least a part of at least one strengthening member is made by injection moulding or 3D printing.

[0013] The surface layer defines the shape of the frame. This means that the thickness of the surface layer may be different at different sections of the frame. As an example, the surface layer may form flanges or grooves configured for use in connecting a pane, sealing gaskets, screening devices etc. to the frame. As another example, the surface layer may be relatively thick at sections where items such as hinges and locking assemblies are to be attached to the frame. This is particularly advantageous if the strengthening portion is not well suited for receiving screws or like fasteners typically used for attaching such items.

[0014] The presence of the cells arranged in continuation of each other in the longitudinal direction contributes to the insulating properties of the strengthening portion and hence of the entire frame by preventing or reducing the convective heat transfer in the longitudinal direction, which may occur in extruded profiles having air spaces extending over the entire length of the profile.

[0015] To further improve the insulating properties, insulating material may be provided in one or more closed cells in the strengthening portion and/or in spaces between strengthening ribs and/or flanges of least one strengthening member of the strengthening portion. If using such insulating material, it must be ensured that it does not influence negatively on the load-bearing capacity of the strengthening portion, or that it is included in the calculations when designing the strengthening portion. Alternatively, or as a supplement, insulating material may be provided on an outer side of the strengthening portion.

[0016] The insulating material is preferably chosen from the group consisting of expanded polypropylene, expanded polystyrene, polyurethane, expanded polyester, expanded poly-lactic acid, mineral wool, natural fibres, aerogel, air, vacuum, and mixtures thereof.

[0017] The strengthening portion or one or more strengthening members of the strengthening portion may be composed of two or more interconnected parts. Particularly it is envisaged that strengthening members made from two half-shells each extending in the length direction of the strengthening member will be advantageous. It is also envisaged that the strengthening ribs and/or flanges may be provided as a separate part, which is sandwiched be-tween two or more shell parts for the construction of a strengthening member or the strengthening portion.

[0018] Strengthening members and/or parts thereof may be interconnected solely by the moulding material used for the surface layer, but may also be provided with connectors as will described in more detail later.

[0019] The strengthening portion may include one or more reinforcement sections adapted for the attachment of an item transmitting force to or from the frame, such as a hinge, a locking assembly, or an actuator. Such reinforcement sections may for example be sections when the strengthening ribs and/or flanges are particularly strong, where there are more strengthening ribs and/or flanges. A reinforcement section may also be achieved by the use of a stronger material or by including reinforcement in the strengthening portion. Reinforcement may be in the form of inlays of for example metal or glass fibre, but it is also possible to provide the strengthening portion with increased flexural resistance by the addition of a material chosen from the group consisting of wood, cellulose or other natural fibres, glass fibres, talcum, $CaCO_3$, carbon fibres, graphite, nanofiber, and combinations thereof. The content of such materials may vary over the length, width, and/height of a strengthening member. In one example the strengthening portion comprises a polymer comprising glass fibres. In another example the strengthening portion comprises a polymer comprising wood fibres.

[0020] The frame may further include hinges, brackets or like fittings adapted for connecting the frame directly or indirectly to a load bearing construction of a building. Such fittings may be embedded in the surface layer or attached to it and should preferably be connected to the frame in a manner allowing a direct transmission of forces to/from the strengthening portion, for example by screws or like fasteners used for the attachment penetrating into the strengthening portion.

[0021] The surface layer may comprise a polymer suitable for use with reaction injection moulding, such as polyurethane. The surface layer may further comprise an outer layer which provides a surface finish. This may take the form of a coating or paint, UV resistance layer, flame inhibiting layer, foil or other similar part.

[0022] A window can be provided comprising a stationary frame and a sash, with at least one of the stationary frame or sash comprising a window frame adapted for use as a sash or a stationary frame according to the first aspect of the present invention.

[0023] In this window, the stationary frame and sash are connected by hinges and secured by at least one locking assembly, the sash comprises at least one gasket and an insulated glazing and the stationary frame preferably comprises brackets adapted for connecting it directly or indirectly to a load bearing construction of a building.

[0024] The window benefits from the weight and strength characteristics of the frame incorporated therein.

[0025] In a second aspect of the invention the object

is achieved with a method for making a window frame for a sash or a stationary frame, comprising said frame including a top frame member, a bottom frame member, and two side fame members, these frame members defining a frame plane and each of these frame members having a longitudinal direction extending in the frame plane, said method including:

providing a strengthening portion including at least one strengthening member, said strengthening member including a shell defining an outer surface of the strengthening member, and a plurality of strengthening ribs and/or flanges extending from the shell, said at least one strengthening member of the strengthening portion including a plurality of closed cells arranged in continuation of each other in the longitudinal direction, each cell being delimited by the shell and one or more strengthening ribs and/or flanges, and

covering the strengthening portion wholly or partially with a surface layer by moulding thereby giving the frame desired surface properties.

[0026] As explained with reference to the first aspect of the invention, the strengthening ribs and/or flanges together with the shell provide a light load-bearing structure with cells which the moulding material used for the surface layer is prevented from entering. The result is a frame, which combines the strength and stability of a wood-based strengthening portion with the durability, uniformity and homogeneity of a polymer-based strengthening portion.

[0027] The surface layer may be applied in several ways including spraying or printing, but is it presently preferred that the surface layer is moulded onto the strengthening portion. The strengthening portion is preferably arranged in a mould, which is then filled with the moulding material used for the formation of the surface layer, said moulding material possibly being introduced under pressure in order to establish a good contact between the moulding material and the strengthening portion. If the strengthening portion is made from separate strengthening members, these may be arranged in the mould in a separate state and interconnected solely by the moulding material, but it is presently preferred to also interconnect them by other means, either before or after applying the surface layer.

[0028] It is presently preferred that the surface layer is made from polyurethane (PUR), but materials chosen from the group consisting of polypropylene, acryl-nitrile-styrene-acrylate, styrene-acryl-nitrile, polycarbonate, polyethylene, poly-butylene-terephthalate, other plastics, aluminium, other metals, rubber, natural fibres and combinations thereof are also possible. The surface layer can be made by reaction injection moulding (RIM) using a thermosetting polymer, such as polyurethane.

[0029] In one embodiment at least two strengthening parts are interconnected thereby forming a strengthening member of the strengthening portion or the entire strengthening portion may be made by interconnecting two or more strengthening parts. In such cases these strengthening parts are preferably interconnected by welding, gluing, and/or snap-locking. Welding will usually provide an interconnection which is sufficiently tight to prevent a moulding material used for creating the surface layer from penetrating between the strengthening parts and into the cells of the strengthening member or strengthening portion. Snap-locking provides a faster and easier interconnection, and can also provide the required degree of sealing. In order to improve the degree of sealing, it may be necessary to supplement the snap-locking with welding or gluing or using tape at critical places, or to provide a sealing gasket or the like at the joint(s) between the strengthening parts. Screws, brackets, clamps, pins, and splits and other mechanical fasteners may also be employed.

[0030] The strengthening portion, separate strengthening members, or parts of strengthening members may be made by any suitable process, but injection moulding, exjection®, foamed injection, blow moulding, 3D printing, lamination, vacuum forming, deep drawing, or combinations thereof are presently preferred. 3D printing allows the formation of very complex structures including closed cells without the need for interconnecting parts. Considering the present state of the 3D-printing technology, however, injection moulding of interconnectable parts is considered advantageous, particularly for industrial scale. Also moulding, for example injection moulding, allows embedding fibres in the material with random orientation for increased stiffness and strength in multiple directions.

[0031] If it is desired to provide the frame with improved insulating properties, insulating material may be provided as described with reference to the first aspect of the invention. In such case the insulating material may be blown into or moulded in the strengthening portion. Examples of materials, which are suitable for blowing, are beads of expanded polystyrene and organic fibres. An example of a material suitable for moulding is foamed polyurethane, which can be introduced in liquid form and turn into foam once in the strengthening portion as a result of a chemical reaction.

[0032] When the surface layer has been applied the frame may be provided with an insulating pane element and/or one or more fittings, such as hinges or mounting brackets, adapted for connecting the frame directly or indirectly to a load bearing construction of a building.

[0033] The details of the strengthening portion, the surface layer, and the frame as such described above with reference to the first aspect of the invention also applies to the second aspect of the invention and vice versa unless otherwise stated. Thus, the method of the second aspect applies to frames according to the first aspect.

Brief Description of Drawings

[0034] In the following, the invention will be described in more detail with reference to the drawings, where:

Fig. 1 shows a frame for a centre-hung roof window in a perspective view with strengthening members depicted along a top frame member and a side frame member,
Fig. 2 shows a strengthening portion for a sash for a centre-hung roof window and a sash made with such a strengthening portion in a perspective view,
Fig. 3 shows the strengthening portion in Fig. 2 in an exploded view with two strengthening members arranged one above the other,
Fig. 4 shows the two strengthening members of Fig. 3 next to the sash of Fig. 2,
Fig. 5 corresponds to Fig. 4 but seen from a different perspective,
Fig. 6 shows a cross-section through the sash in Fig. 2 as indicated by the arrows VI,
Fig. 7 shows a strengthening portion for a stationary frame of a sky-light in a perspective view,
Fig. 8 shows one of the strengthening members used for making the strengthening portion in Fig. 7,
Fig. 9 shows another embodiment of a strengthening portion for a sash as shown in Fig. 2 in an exploded view, and
Fig. 10 shows still another embodiment of a strengthening portion for a sash as shown in Fig. 2 in an exploded view.

Description of Embodiments

[0035] A frame 1 for use as a stationary frame for a centre-hung roof window is shown in Fig. 1. The frame includes a top frame member 11, a bottom frame member 12, and two side fame members 13,14. Each of these frame members has a longitudinal direction L (shown only at the top and right side) and together they define a frame plane P (indicated in the lower left corner). An inner opening 15 of the frame is delimited by the frame members.

[0036] The frame is composed of a strengthening portion, which has been over-moulded with a surface layer 16 which gives the frame desired surface properties by defining its outer shape. In this case the surface layer is made from polyurethane, thus also making the frame waterproof and providing good thermal insulation properties. Other materials may provide other properties and may need surface treatment for waterproofing, such as paint. The surface layer 16 encompasses the presence of a surface finish by a coating (not shown). Other layers such as paint, UV resistance layer, flame inhibiting layer, foil or other similar surface additions may be used.

[0037] In Fig. 1 the surface layer 16 covers the strengthening portion entirely, but it is also possible to leave smaller sections of strengthening portion uncovered, for example to facilitate the insertion of screws, installation brackets, actuators, springs, pins or other fasteners, which need to be connected to the strengthening portion, or to allow filling the strengthening portion with insulation or for ventilation of the strengthening portion.

[0038] Strengthening members 31 and 33 used for the formation of the strengthening portion within the frame 1 are shown along the top frame member 11 and left side frame member 13, respectively, in Fig. 1. These strengthening members are adapted for being interconnected with two similar members (not shown) at the right side and at the bottom, respectively, by being provided with connectors 4. In this embodiment the top strengthening member 31 is provided with projections 41 adapted for being inserted in openings 43 in the side strengthening members 33. The engagement between these openings and the projections may be stabilized for example by a tight fit, by snap-locking or press fitting, by fasteners being inserted into both parts, or by gluing or welding. It is, however, also possible that they are just fitting loosely and that a stable connection is achieved by the moulding material used for the surface layer flowing in between them and fixing them in relation to each other.

[0039] In another embodiment (not shown) all strengthening members are provided with openings and separate corner brackets are used for interconnecting them.

[0040] At the centre of some strengthening members is a reinforcement section 5, which is positioned where locking assemblies and hinges (not shown) will be secured to the finished frame 1. The bigger cross-section and additional material at these sections allow the strengthening portion to better take up forces transmitted from the locking assemblies and hinges. It is also possible to include parts consisting wholly or partially of different material, such as metal or glass fibre, in the strengthening portion at the reinforcement sections 5.

[0041] Separate reinforcement members are preferably made from a material chosen from the group consisting of steel, aluminium, pultruded profile, wood, natural fibres, carbon fibres, glass fibre tape, plastic or combinations thereof.

[0042] Openings 61 in the reinforcement sections are intended for receiving mounting pins or other fasteners used for attachment of the locking assemblies, hinges, etc. These openings may be filled partially by the material used for the surface layer in order to ensure a continuous surface on the frame.

[0043] Other openings 62 are provided for receiving other fasteners used, for example for attachment of covering and cladding members, and similar openings on a sash may be used for attachment of an insulated glass unit.

[0044] Still further openings 63 are provided in order to give the individual strengthening member 31, 33 and consequently the resulting strengthening portion the desired strength and stiffness. Depending on how the mould used for making the surface layer is embodied, some of

these openings may be filled wholly or partially with the moulding material used, while others are kept open such that at least one closed cell is formed in the interior of the strengthening member. The straight sections 64 of the strengthening members 31, 33 extending in the longitudinal direction in Fig. 1 is thus a shell defining an outer surface of the strengthening member and the inclined sections 65 and pillar sections 66 extending perpendicular to the longitudinal direction L constitutes a plurality of strengthening ribs and/or flanges extending from the shell in order to provide extra strength and stiffness.

[0045] The inclined sections 65 and pillar sections 66 could also be made hollow in which case closed cells would be formed in their interior.

[0046] The reference numbers used on the strengthening members 31,33 in Fig. 1 have also been used in the remaining figures for features having substantially the same function and these features will not be described in further detail.

[0047] Fig. 2 shows another embodiment of the invention, namely a frame 2 for use as a sash for a centre-hung roof window and a strengthening portion 3 for use as a core therein. As described with reference to the frame 1 above, the sash 2 includes a top sash member 21, a bottom sash member 22 and two sides sash members 23, 24 delimiting a sash opening 25, and the strengthening portion includes corresponding members, i.e. a top strengthening member 31, a bottom strengthening member 32, and two side strengthening members 33,34. The strengthening members 31,32,33,34 here form part of an integral strengthening portion and are thus not separate interconnected members as described with reference to Fig. 1. It is, however, to be understood that un-less otherwise stated the details described with reference to Fig. 1 could also be applied in a frame intended for use as a sash, and that the details described with reference to Figs 2-6 also apply to frames intended for use as stationary frames. This for example means that the strengthening portions 3 in Figs 2-6 and 9 could be composed of separate members inter-connected by connectors 4 as described with reference to Figs 1 and 7-8 even though described with reference to two half-shells.

[0048] Figs 3-5 show more details of the strengthening portion and sash shown in Fig. 2. In Fig. 3 the strengthening portion 3 is shown in an exploded view and it is seen that it is composed of two parts, an upper half-shell 35 and a lower half-shell 36. These half-shells are intended for production by injection moulding, but may of course be produced in other ways, 3D-printing being considered as promising technology. Though not shown this embodiment, they too may be supplemented with separate reinforcement members as described above.

[0049] Each of the half-shells 35,36 include a plurality of ribs and flanges 72, and when the half-shells are interconnected, these ribs and flanges delimit a plurality of closed cells 71 within the strengthening portion as is also seen from the cross-section along the frame plane shown in Fig. 6.

[0050] It is presently preferred that the two half-shells 35,36 are interconnected solely by friction or snap-locking before being over-moulded with the surface layer as this will make the manufacturing process easy and quick, but it is also possible to interconnect them by other means. At present, welding, including laser welding, ultrasonic welding, and heat welding, is preferred if needing to apply alternative interconnecting means, but glues, adhesives and mechanical fasteners may also be employed. Regardless how the different parts are interconnected it should be ensured that the amount of surface layer moulding material unintentionally entering the spaces between the parts is kept at a minimum. Sealing and gaskets may be used for this purpose. These considerations regarding means for interconnecting parts apply to all embodiments of the invention, not only to embodiments including two half-shells.

[0051] The air captured in the closed cells 63, 71 provides the finished frame with excellent insulating properties, but is also possible to provide insulating material or a vacuum within some or all of these closed cells. Insulating material may be made by expansion in a mould, expansion in the strengthening portion, expansion and extrusion, foaming, vacuum forming, milling, 3D printing, casting, blowing, suction, or combinations thereof.

[0052] The cells 63, 71 further ensure that the weight of the strengthening portion is low compared to a traditional wooden strengthening portion. The size, shape, and position of the ribs, flanges, and cells may vary depending on demands for strength and stiffness and the material(s) used.

[0053] A third embodiment of a strengthening portion 3 is shown in Figs 7 and 8. This strengthening portion is adapted for use in the frame or sash of a sky-light.

[0054] This strengthening portion too includes closed cells in the interior (not shown). Here the cells are delimited by ribs which extend from one side of the shell forming the outer surface of each strengthening member 31,32,33,34 to the other and flanges 73 are provided on the outer side of the strengthening portion opposite each of these ribs.

[0055] In this embodiment the frame is composed of four separate strengthening members 31,32,33,33 which are interconnected by snap-locking connectors 4. Each strengthening member includes an integral corner section 37, which extends in the frame plane and perpendicular to the longitudinal direction L so that in the assembled state it extends in parallel with the longitudinal direction of another strengthening member. This ensures that there are no interconnections at the corners, which are often subject to relatively high loads. The length of the corner section may vary depending on the expected loads on the frame in which the strengthening portion is to be used.

[0056] Fig. 9 shows an embodiment corresponding substantially to that shown in Figs. 2-5, but as may be best seen by comparing to Fig. 3, it includes a separate

top strengthening member 38 in addition to the two half shells. This separate top strengthening member 38 is made from a stronger material than the two half-shells in order to provide additional strength where the locking assembly (not shown) is to be attached. When the strengthening portion 3 is assembled, the separate top strengthening member 38 is sandwiched between the half-shell and eventually fixated in this position by the surface layer. In other examples a separate strengthening member 38 may be provided in the side or bottom members.

[0057] A still further embodiment of a strengthening portion 3 consisting of eight separate strengthening members is shown in Fig. 10. This embodiment combines the advantages of using separate members with the advantages of using half-shells by each strengthening member being composed of two half-shells. The top strengthening member is composed of an upper part 31 a and a lower part 38 corresponding to the separate member 38 shown in Fig. 9, the bottom strengthening member is composed of an upper part 32a and a lower part 32b, and the side strengthening members are composed of upper parts 33a,34a and lower parts 33b,34b. This embodiment too includes closed cells 71 defined by ribs and flanges on the upper and lower parts coming together when parts are assembled.

[0058] It is noted that the features described with reference to Figs 7-10 are not limited to the specific types of frame shown and described but may also be employed in the frames of Figs 1-6 and vice versa. Likewise, the features and principles described with reference to any of the embodiments above may be used in other frames for windows unless otherwise stated.

Claims

1. A window frame adapted for use as a sash or a stationary frame, said frame including a top frame member, a bottom frame member, and two side fame members, these frame members defining a frame plane and each of these frame members having a longitudinal direction extending in the frame plane, said frame comprising a strengthening portion and a moulded surface layer covering the strengthening portion wholly or partially and giving the frame desired surface properties, where at least one strengthening member of the strengthening portion includes a shell defining an outer surface of the strengthening member, and a plurality of strengthening ribs and/or flanges extending from the shell, **characterized in that** said at least one strengthening member of the strengthening portion includes a plurality of closed cells arranged in continuation of each other in the longitudinal direction, each cell being delimited by the shell and one or more strengthening ribs and/or flanges.

2. A window frame according to claim 1, where at least a part of at least one strengthening member is made by injection moulding or 3D printing.

3. A window frame according to claim 1 or 2, where the surface layer defines the shape of the frame.

4. A window frame according to one or more of the preceding claims, where at least one strengthening member of the strengthening portion is composed of two or more inter-connected parts and/or where the strengthening portion is composed of two or more inter-connected strengthening members.

5. A window frame according to one or more of the preceding claims, where insulating material is provided in or on at least one strengthening member of the strengthening portion.

6. A window frame according to one or more of the preceding claims, where the strengthening portion includes at least one reinforcement section adapted for the attachment of an item transmitting force to or from the frame, such as a hinge, a locking assembly or an actuator.

7. A window frame according to one or more of the preceding claims, where the at least one strengthening member of the strengthening portion includes a plurality of ribs and/or flanges which form a lattice-like structure and are provided along at least a part of the strengthening portion, such as, at least half of the strengthening portion.

8. A window frame according to one or more of the preceding claims, wherein the ribs and/or flanges extending from the shell are positioned along the length of the shell such that the strength of the strengthening portion is increased in the longitudinal direction extending in the frame plane.

9. A window frame according to one or more of the preceding claims, wherein the strengthening portion comprises a polymer with a fibre filler.

10. A window frame according to one or more of the preceding claims, wherein the surface layer comprises a polymer suitable for use with reaction injection moulding, such as polyurethane.

11. A window comprising a stationary frame and a sash, wherein at least one of the stationary frame or sash comprises a window frame adapted for use as a sash or a stationary frame according to one or more of the preceding claims,
wherein the stationary frame and sash are connected by hinges and secured by at least one lock,
and further wherein the sash comprises a gasket and

an insulated glazing and preferably comprises brackets adapted for connecting the stationary frame directly or indirectly to a load bearing construction of a building.

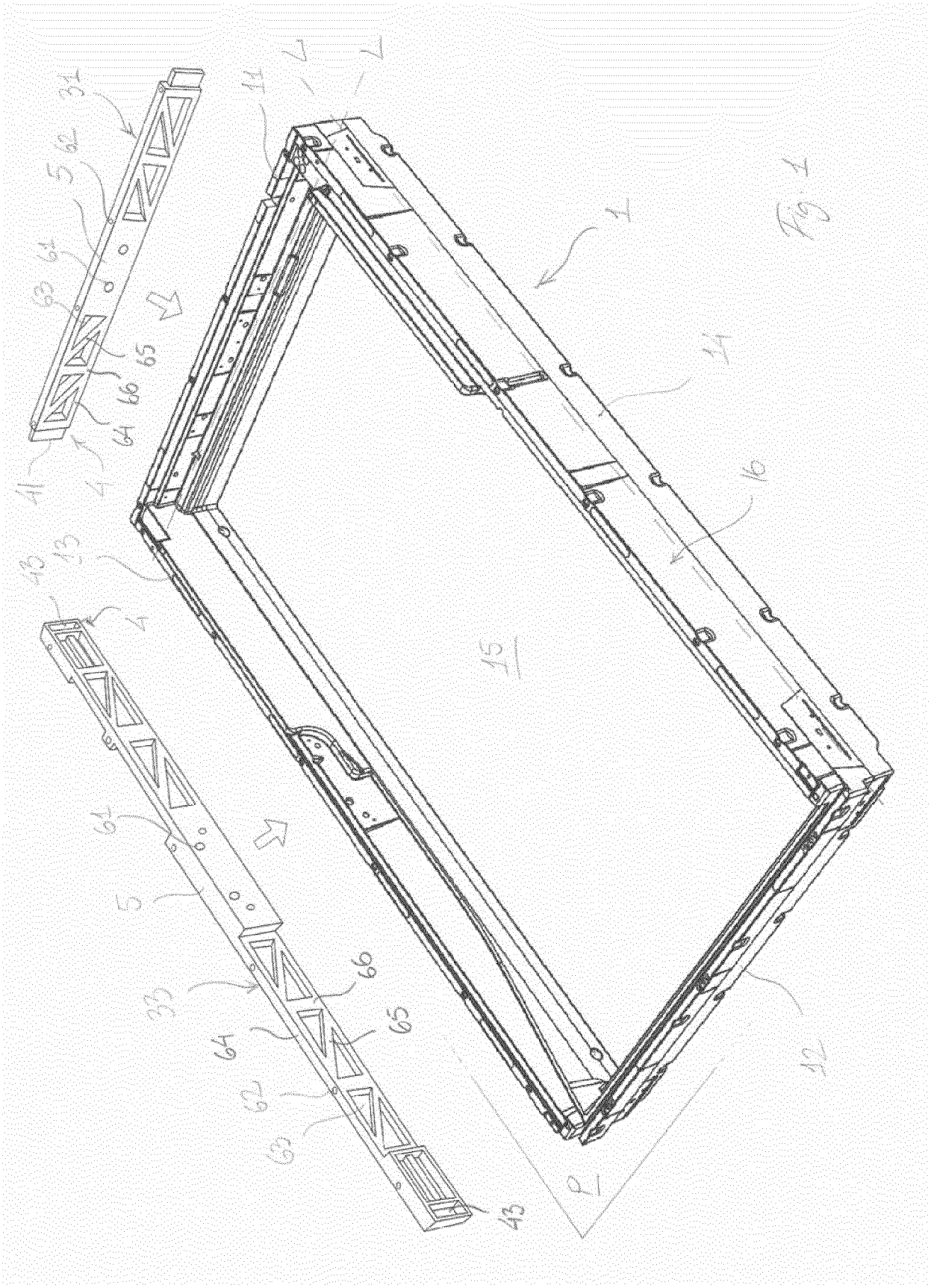
12. A method for making a window frame for a sash or a stationary frame, comprising said frame including a top frame member, a bottom frame member, and two side fame members, these frame members defining a frame plane and each of these frame members having a longitudinal direction extending in the frame plane, said method including:

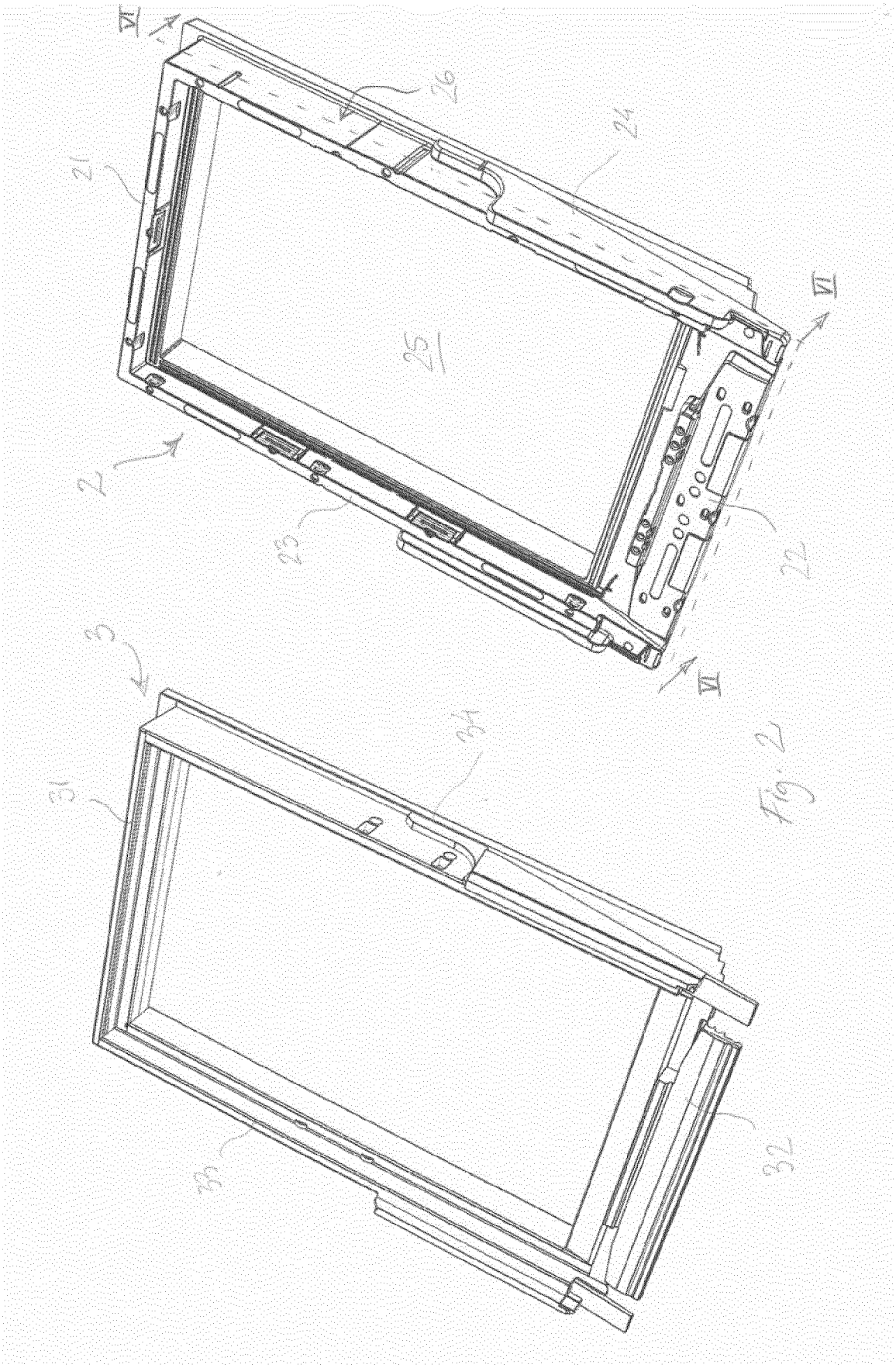
providing a strengthening portion including at least one strengthening member, said strengthening member including a shell defining an outer surface of the strengthening member, and a plurality of strengthening ribs and/or flanges extending from the shell, said at least one strengthening member of the strengthening portion including a plurality of closed cells arranged in continuation of each other in the longitudinal direction, each cell being delimited by the shell and one or more strengthening ribs and/or flanges, and
covering the strengthening portion wholly or partially with a surface layer by moulding thereby giving the frame desired surface properties.

13. A method according to claim 12, where at least two strengthening parts are interconnected thereby forming a strengthening member, and/or where two or more strengthening members are interconnected forming the strengthening portion, said strengthening parts and/or strengthening members preferably being interconnected by welding, gluing, and/or snap-locking.

14. A method according to one or more of claims 12-13, where at least a part of at least one strengthening part or strengthening member is made by injection moulding, exjection, foamed injection, blow moulding, 3D printing, lamination, vacuum forming, deep drawing, or by combining processes.

15. A method according to one or more of claims 12-14, where the window frame is a window frame according to one or more of claims 1-11.




VI
29
24
21
25
VI
2
23
22
3
31
34
Fig. 2
33
32

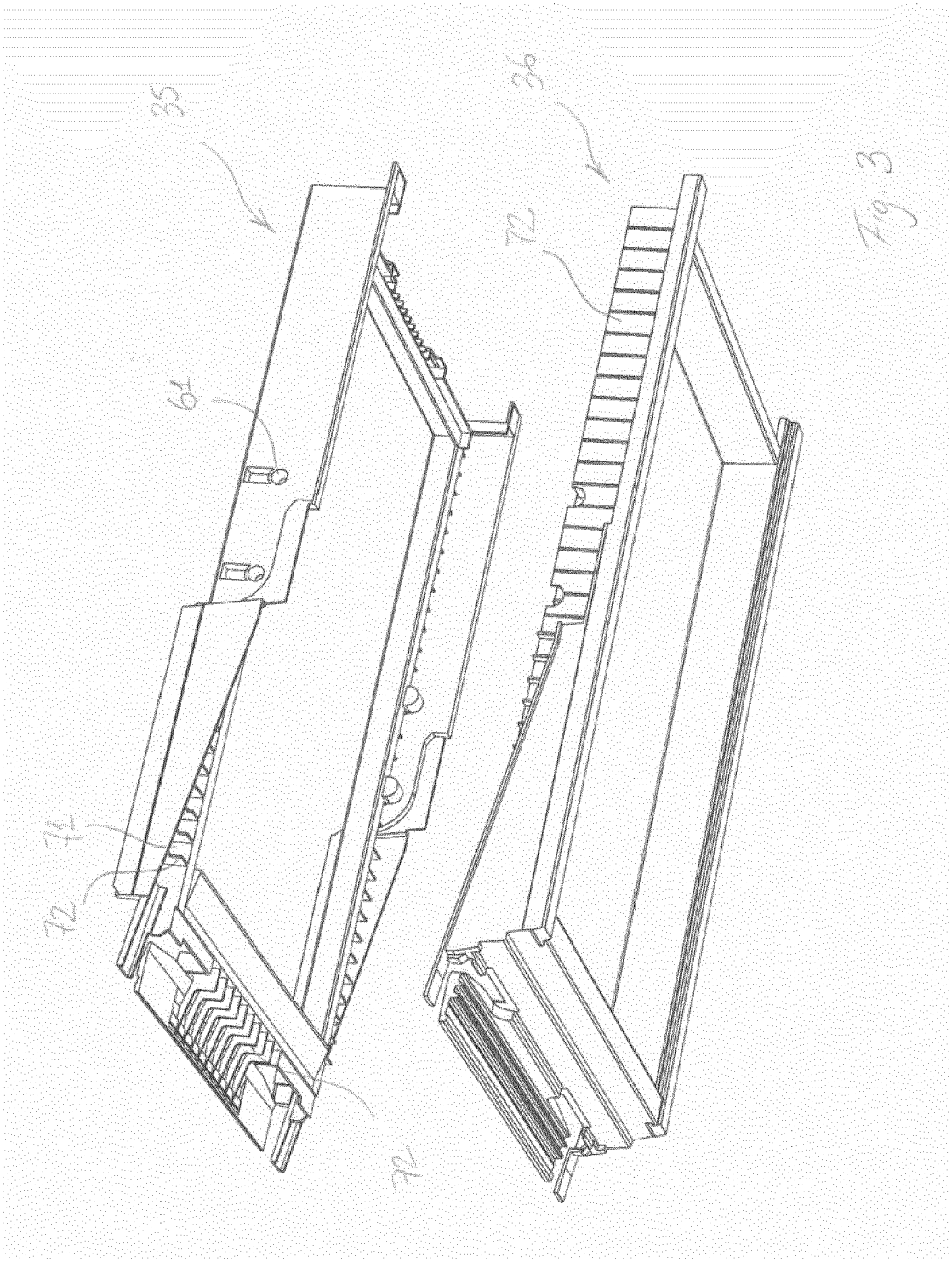


Fig. 3

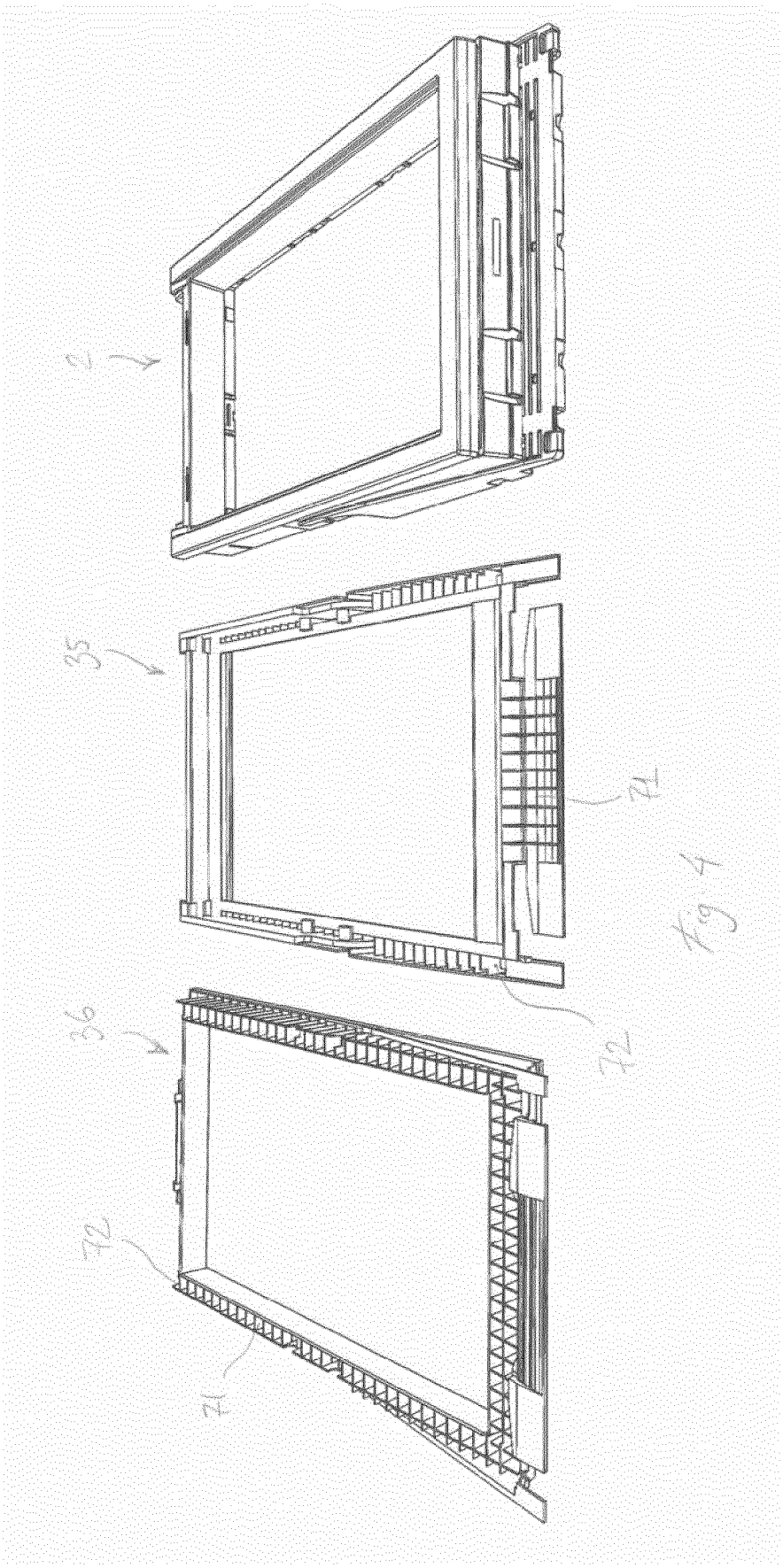


Fig. 4

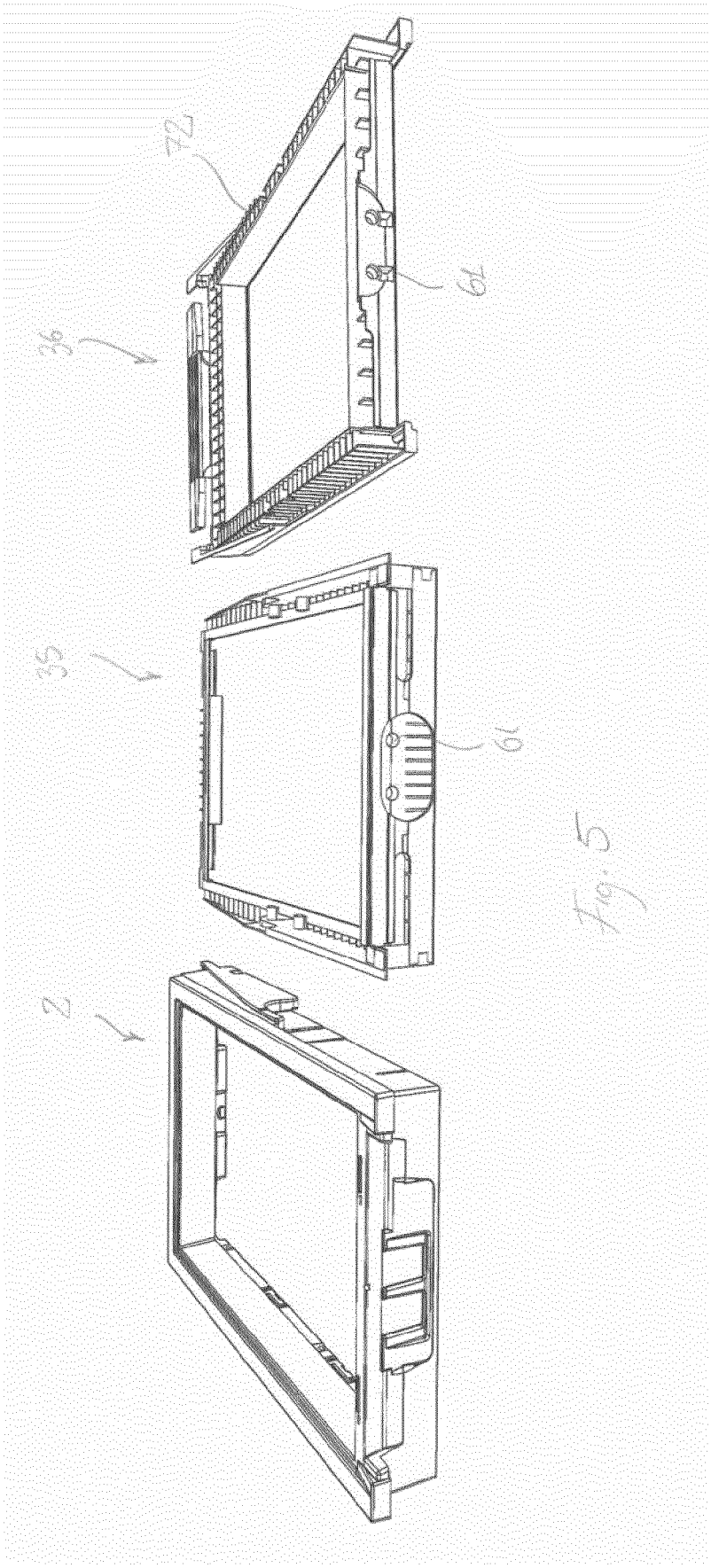
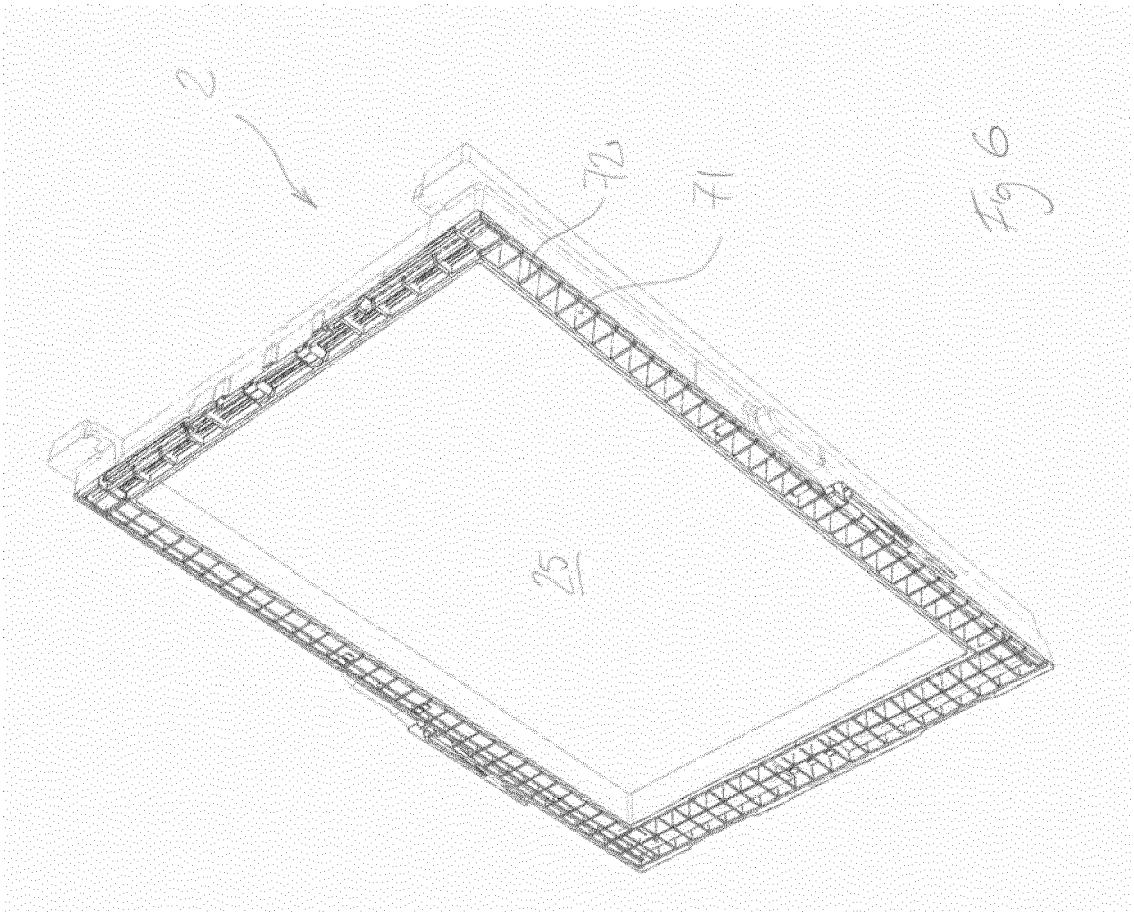


Fig. 5


D
72
71
Fig 6
251

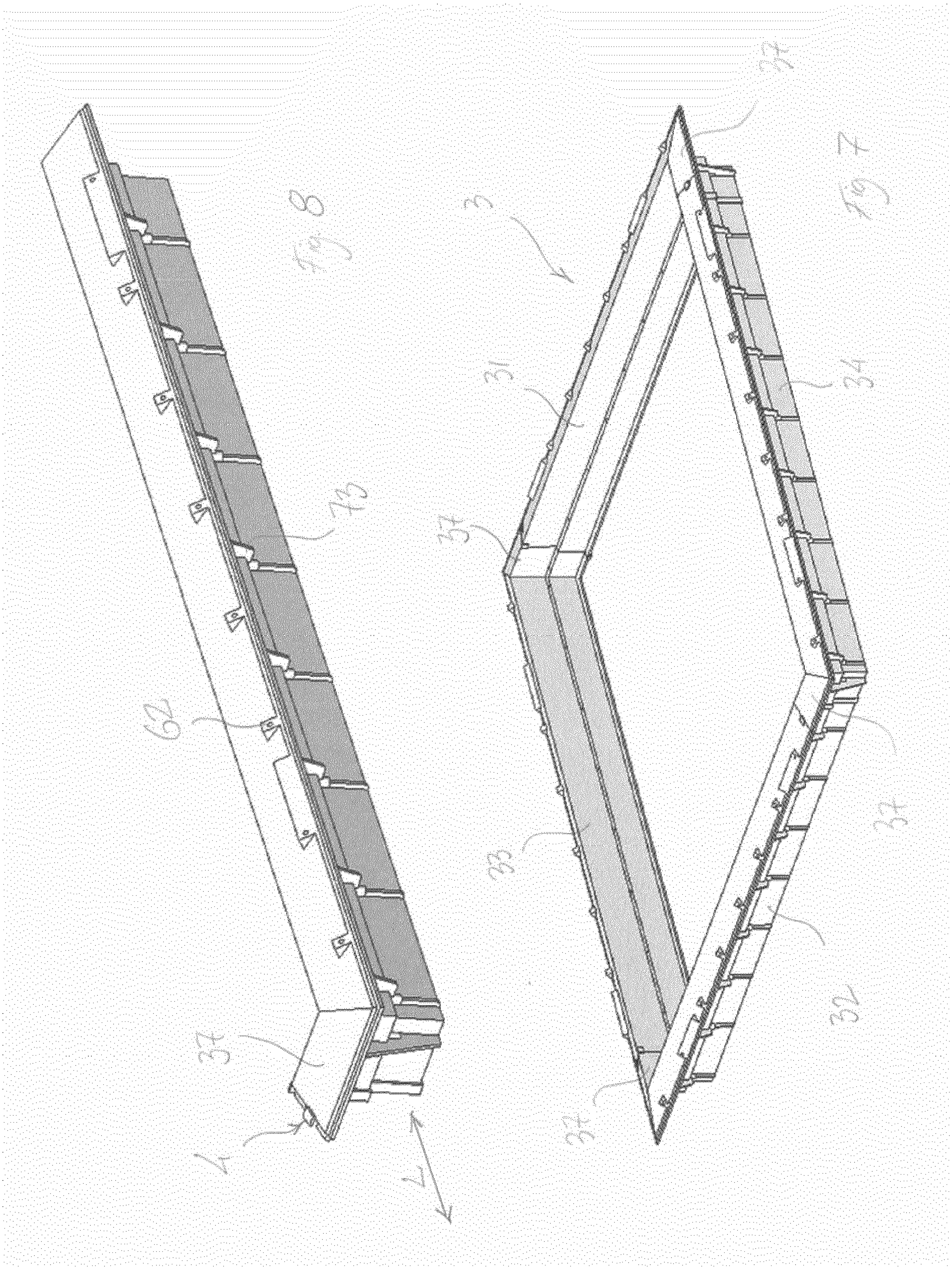


Fig. 8
Fig 7
3
31
32
33
34
37
62
73
4
L

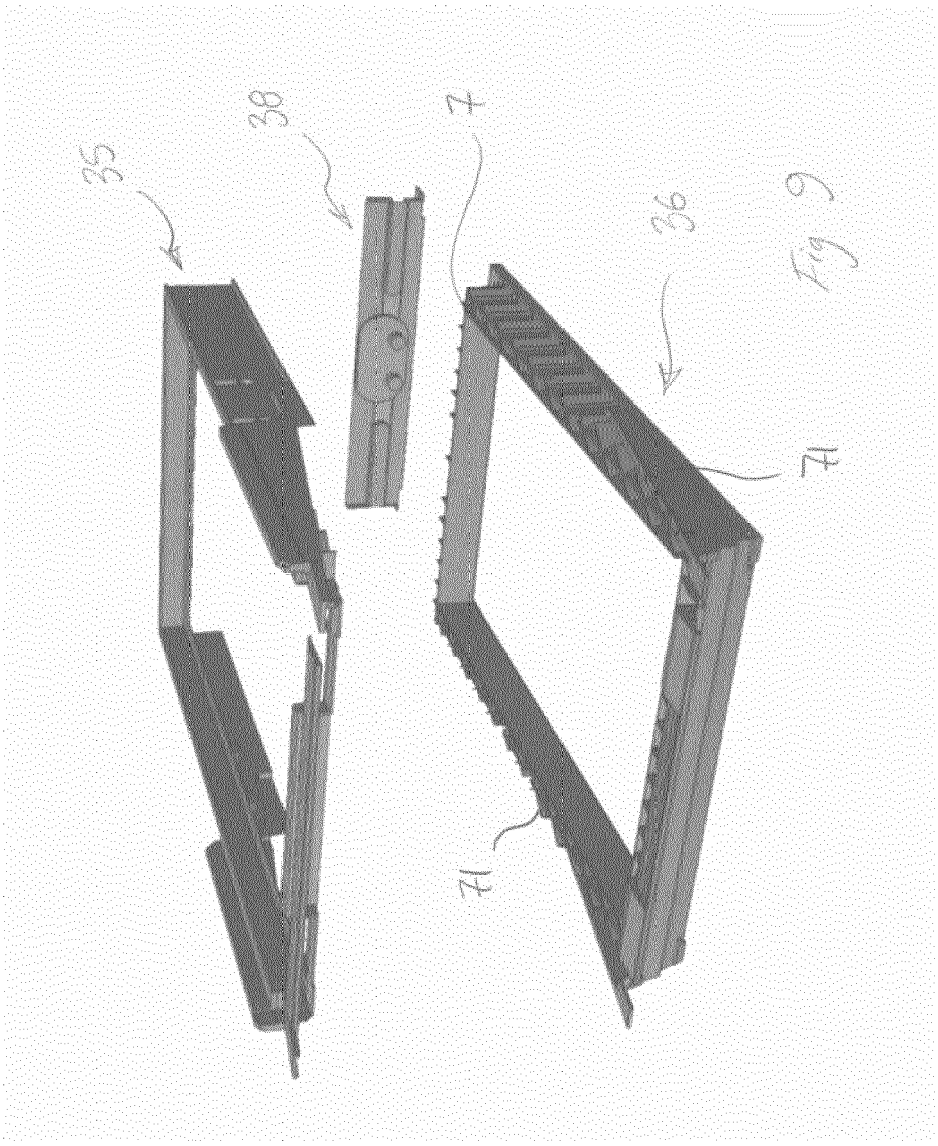


Fig 9

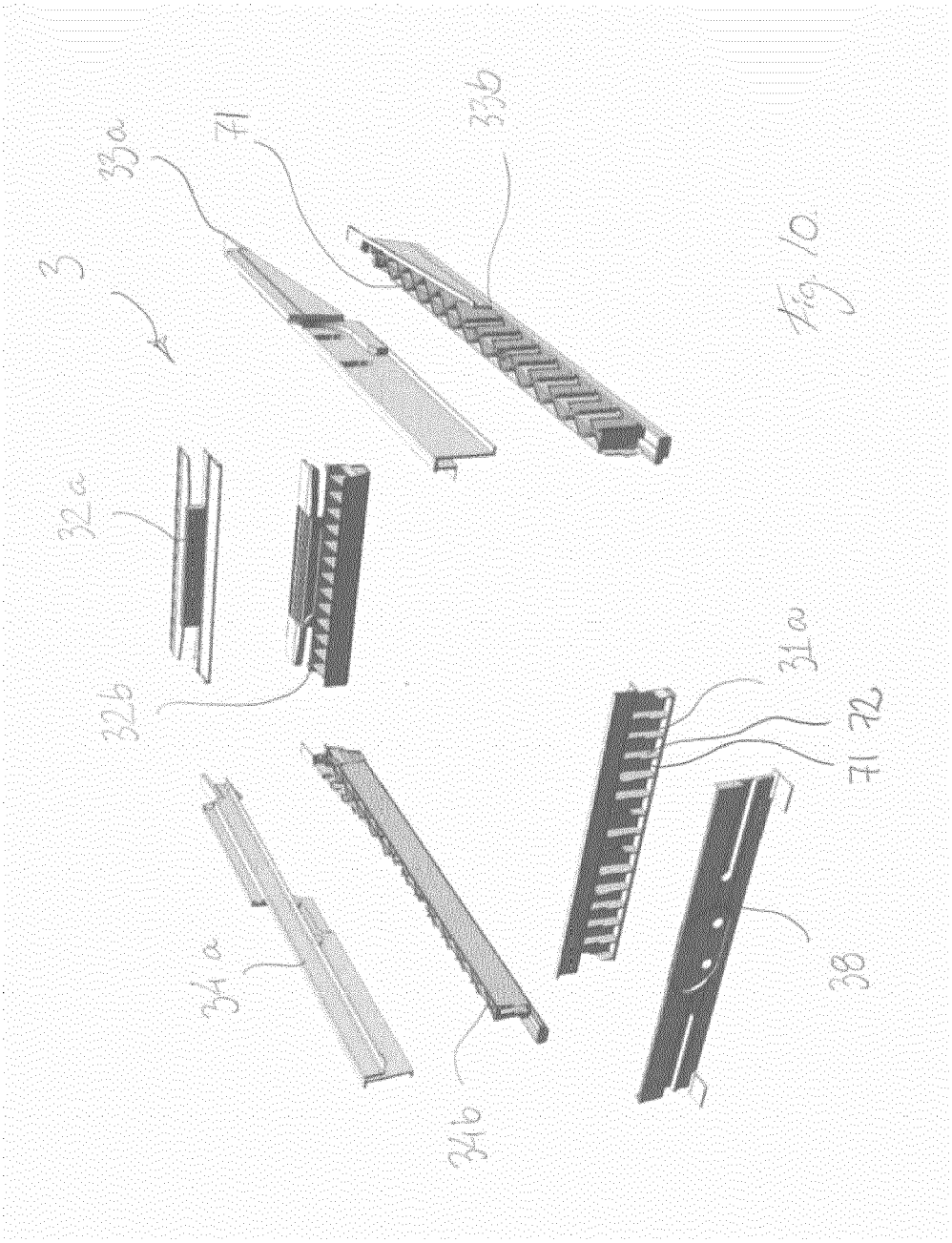


Fig. 10.

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 18 4756

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,D	US 2009/094929 A1 (CARLSON BARRY L [US] ET AL) 16 April 2009 (2009-04-16)	1-6,8,9, 11,12, 14,15	INV. E06B3/30 E06B3/20
Y	* paragraphs [0049] - [0072]; figures 5-8,38,39,48-51 *	7,13	ADD. E04D13/035
X	US 4 341 831 A (KLEISS JOACHIM) 27 July 1982 (1982-07-27) * the whole document *	1-6, 8-12,14, 15	
Y	US 5 634 306 A (RIEGELMAN HARRY M [US]) 3 June 1997 (1997-06-03) * column 7,, lines 57-60; figure 12 *	7	
Y	DE 27 02 156 A1 (MERGLER WALTER) 27 July 1978 (1978-07-27) * page 7; figures 6,7 *	13	

TECHNICAL FIELDS SEARCHED (IPC)
E06B
E04D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 November 2019	Hellberg, Jan

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 18 4756

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.

21-11-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009094929 A1	16-04-2009	US 2009094929 A1	16-04-2009
		US 2012304569 A1	06-12-2012
		US 2014199514 A1	17-07-2014
US 4341831 A	27-07-1982	NONE	
US 5634306 A	03-06-1997	NONE	
DE 2702156 A1	27-07-1978	NONE	

EPO FORM P0459

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

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 2167770 A1 **[0002]**
- US 20090094929 A1 **[0003]**