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(54) Title: FLEX BUILDING SYSTEM WITH PULTRUDED MATERIAL FRAME

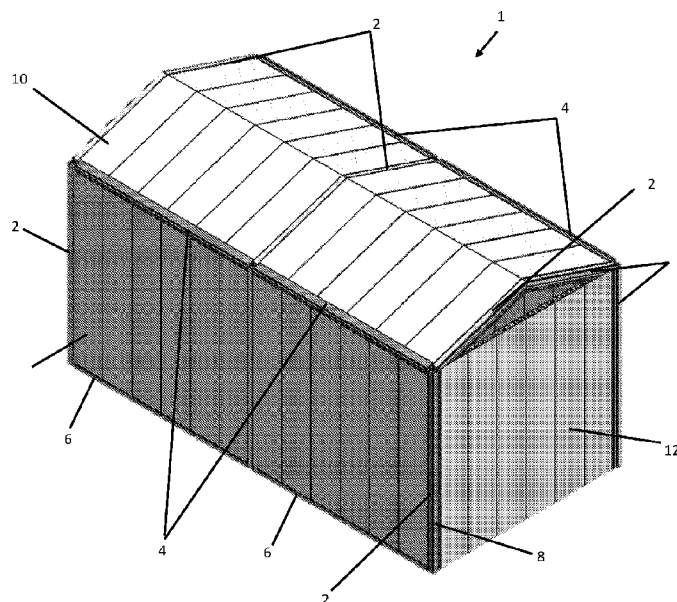


FIG. 1

(57) Abstract: The teachings generally relate to a modular building system with a pultruded frame that includes one or more T-shaped connectors; one or more wall-to-roof connection beams; and one or more U-channel pieces. The modular building system also includes one or more roof panels and one or more wall panels. The pultruded frame connects and holds the one or more wall panels and the one or more roof panels forming a modular building.



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FLEX BUILDING SYSTEM WITH PULTRUDED MATERIAL FRAME

FIELD OF THE INVENTION

- [001]** The present teachings relate generally to pultruded thermoset polyurethane forming the frame of a modular building structure, including rubberized gasket type seal connecting the wall panels to the pultruded frame.

BACKGROUND OF THE INVENTION

- [002]** There is an ongoing effort in many industries to lighten the weight of articles. In many instances, this is achieved by the selection of materials that have a lower density, thinner section thicknesses or both, as compared with prior materials or structures. As a result, there is a potential for the weakening of structures, and the consequent need for stiffening or other structural reinforcement.
- [003]** The present invention relates to modular building systems which focus on replacing typical construction materials such as bricks, concrete, and wood with lighter, pre-fabricated materials. Current modular building system frames are made of extruded aluminum and or extruded PVC. Although these materials are acceptable alternatives to traditional building materials for modular systems, extruded PVC and aluminum both have short comings. When forming the frame of a modular building system with extruded PVC, the structural PVC must be reinforced with steel pieces to increase structural integrity. When using extruded aluminum, insulation and corrosion are two major shortcomings of the material because aluminum is subject to a high heat transfer rate and will oxidize over time.
- [004]** It is desirable to utilize a material in forming the frame and panels of the modular building system which provides structural integrity, insulative properties and is corrosion-free after exposure to the elements.

SUMMARY OF THE INVENTION

- [005]** It is one object of the present teachings to provide for the frame of a modular building which provides structural integrity and greater insulation over the known methods, in addition to being free from oxidation and corrosion.
- [006]** The materials of the present teachings also find application in a number of other applications as will be gleaned from the following discussion. That is, the present teachings relate generally to composite materials, and more particularly to fibrous composite materials and a thermoplastic polymeric material. The material offers the benefit of mechanical properties typically achieved through the use of thermoset polymeric materials as some or all of a matrix phase of a composite. However, the material has a number of physical attributes that make it suitable for handling, processing and/or post-useful life reclamation, recycling, and/or re-use.
- [007]** The present teachings meet one or more of the present needs by providing: a modular building system including: a pultruded frame including: one or more T-shaped connectors; one or more wall-to-roof connection beams; and one or more U-channel pieces; one or more wall panels; and one or more roof panels; wherein the pultruded frame connects and holds the one or more wall panels and the one or more roof panels forming a modular building.
- [008]** The one or more wall panels may be formed from a pultruded thermoset material. The one or more roof panels may be formed from a pultruded thermoset material. The pultruded frame may be filled with an expandable foam insulation. The pultruded frame may connect the one or more walls and the one or more roof panels with a rubberized gasket seal. The pultruded frame may further include one or more closeout connectors. The one or more closeout connectors may be connected to pieces of the pultruded frame that have a free channel and are located on an exterior of the modular building. The one or more U-channel pieces may form a base of the pultruded frame. The one or more U-channel pieces may connect to a bottom portion of the one or more wall panels.
- [009]** The one or more T-shaped connection beams may have at least two channels. The one or more T-shaped connection beams may have at least three channels. Each one

of the at least two channels may accept one of the one or more wall panels, one of the one or more roof panels, or a piece of the pultruded frame. Each one of the at least three channels may accept one of the one or more wall panels, one of the one or more roof panels, or a piece of the pultruded frame. The one or more wall-to-roof connection beams may connect the one or more wall panels with the one or more roof panels. The one or more wall panels may include one or more steel reinforcing pieces located within the one or more wall panels. The one or more roof panels may include one or more steel reinforcing pieces located within the one or more roof panels. The one or more wall panels and the one or more roof panels may be made from the same material. The one or more wall panels and the one or more roof panels may be made from dissimilar materials.

[0010] One or more components of the pultruded frame may comprise a polyurethane-based pultruded material. One or more components of the pultruded frame may comprise a thermoplastic epoxy-based pultruded material. One or more wall panels and/or one or more roof panels may be contacted with a sound-absorption comprising a lofted non-woven material. One or more wall panels and/or one or more roof panels may be contacted with a sound-absorption comprising a thermoformed non-woven material. One or more wall panels and/or one or more roof panels may be contacted with an adhesive film material. One or more components of the pultruded frame may comprise an adhesive film material. The adhesive film may comprise a thermoplastic epoxy material. The adhesive film may comprise a thermoset structural adhesive material. One or more components of the pultruded frame may comprise one or more pultruded fibers. The one or more pultruded fibers may be selected from carbon fibers, glass fibers, or thermoplastic epoxy fibers. One or more components of the pultruded frame may be curved pultruded members. One or more components of the pultruded frame may be contacted by a foamable sealing material. One or more components of the pultruded frame may be contacted by an injection molded polymeric component. The injection molded polymeric component may comprise a polyamide material. The injection molded polymeric component may comprise a glass-filled material.

DESCRIPTION OF THE DRAWINGS

- [0011] Figure 1 is a perspective view of a modular building incorporating the teachings of the present application.
- [0012] Figure 2 is a cross section of a wall-to-roof connector beam.
- [0013] Figure 3 is a cross section of a T-connection beam.
- [0014] Figure 4 is a cross sectional view of a U-channel piece.
- [0015] Figure 5 is a cross sectional view of a panel used as a wall panel and/or roof panel.
- [0016] Figure 6 is a cross sectional view of a closeout connector.

DETAILED DESCRIPTION

- [0017] The explanations and illustrations presented herein are intended to acquaint others skilled in the art with the invention, its principles, and its practical application. Those skilled in the art may adapt and apply the invention in its numerous forms, as may be best suited to the requirements of a particular use. Accordingly, the specific embodiments of the present invention as set forth are not intended as being exhaustive or limiting of the invention. The scope of the invention should, therefore, be determined not with reference to the above description, but should instead be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. The disclosures of all articles and references, including patent applications and publications, are incorporated by reference for all purposes. Other combinations are also possible as will be gleaned from the following claims, which are also hereby incorporated by reference into this written description.
- [0018] This application claims the benefit of the filing date of United States Provisional Application Serial No. 62/573,837, filed October 18, 2017, the contents of that application being hereby incorporated by reference herein for all purposes.
- [0019] The teachings herein relate to composite articles. The composite articles may be in a form suitable for use as part of a frame and/or structural reinforcement for modular building systems. The composite articles are preferably made by a pultrusion process. Pultrusion is a method of creating composite structures by impregnating a reinforcing fiber with resin and then pulling the reinforced fibers through a heated stationary die

where the resin undergoes polymerization. The resin may be selected to provide the resistance to the environment such as corrosion resistance, UV resistance, impact resistance and the like. The fiber may provide one or more of structural support and flame resistance. Using pultruded composite materials to form a frame of a modular building would allow the structure to be resistant to environmental factors while maintaining adequate structural integrity, reduced weight, and simplified assembly. The pultruded frame is the structure which holds up the modular building. The pultruded frame allows the wall panels and roof panels to be arranged and held in place. The pultruded frame connects the wall panels with one or more adjacent wall panels, the roof panels, other pieces of the pultruded frame, or any combination thereof. The pultruded frame is made up of modular pieces which can be matched and assembled in a variety of configurations in order to form a desired design of a modular building. The structures which make up the frame may be of varying lengths and widths. The frame may be made of several different types of structures which are connected together to support the building. The frame may be secured to the wall panels, the roof panels, the frame components which make up the frame, or any combination thereof by a rubberized gasket seal.

[0020] The frame may include one or more T-connection beams, one or more wall-to-roof connection beams, one or more U-channel pieces, and one or more closeout connectors. The frame includes one or more T-connection beams. The frame may include one or more, two or more, three or more, four or more, or even five or more T-connection beams. The T-connection beam is used to join several components of the structure together at a single point. The one or more T-connection beams may be hollow structures. The hollow portion of the one or more T-connection beams may be filled with an insulating material. The T-connection beam may connect panels, other frame pieces, or a combination thereof. For example, the T-connection beam may connect two panels, two frame pieces, or a combination thereof along the same axis and connect another additional panel and/or frame piece perpendicular to the first two connected pieces, forming a “T” shape. Each of the points of the “T” may include a channel to receive a panel and/or frame piece. Each channel may include one or more protrusions. If at least two protrusions are present, they may be arranged in an opposing relationship to one another, forming opposing protrusions. The protrusions may be located within the

channel to help secure one or more wall and/or roof panels and/or other components of the pultruded frame. The T-connection beam may slightly deform when a panel and/or a frame piece is inserted into any of the openings of the T-connection beam allowing a friction fit between the opposing projections and the inserted piece. To further secure inserted pieces within the T-connection beam, a rubberized gasket-type material may be located within the openings of the beam. It is contemplated that the rubberized gasket-type material may be located on any surface of the T-connection beam which contacts other elements of the modular building. For example, rubberized gasket material may be located on the pair of opposing protrusions within each channel of the T-connection beam.

[0021] The frame may include one or more wall-to-roof connection beams. The frame may include one or more, two or more, three or more, four or more, or even five or more wall-to-roof connection beams. The one or more wall-to-roof connection beams are used to connect the wall panels of the modular building to the roof panels. The one or more wall-to-roof connection beams may be generally hollow structures. They may be generally solid structures. It is contemplated that the hollow portions of the wall-to-roof connection beams may be filled with an insulating material. The one or more wall-to-roof connection beams generally have a modified “z” shape. The wall-to-roof connection beam may have a first flange and second flange offset by a connector portion such that the first flange is located on a first plane and extends away from the second flange, and the second flange is on a second plane and extends in the opposite direction of the first flange. The first flange may be adapted to substantially match the angle of the one or more roof panels which the wall-to-roof connection beam joins. The first flange may be adapted to be connected to the one or more roof panels. To keep the profile of the one or more roof panels, the wall-to-roof panel connection beam includes a member which extends from the connector portion at same angle as the first flange towards the second flange. The second flange may form an end-stop of a channel that is formed by two walls extending downward from the second flange. The first wall may extend downward from the connector piece and the second wall may extend downward from the opposite end of the second flange. The channel is adapted to accept the top portion of the one or more wall panels. The first wall and the second wall of the channel each may include a

protrusion. The wall-to-roof connection beam may slightly deform when the one or more wall panels are inserted into the channel allowing a friction fit between the opposing projections and the inserted wall panels. To further secure the connected pieces to the wall-to-roof connection beam, rubberized gasket-type material may be located within the openings of the beam. It is contemplated that the rubberized gasket type material may be located on any surface of the wall-to-roof connection beam which contacts other elements of the modular building.

[0022] The frame may include one or more U-channel beams. The frame may include one or more, two or more, three or more, four or more, or even five or more U-channel beams. The one or more U-channel beams are used to hold the one or more wall panels together, as well as close and seal the bottom portion of the wall panels. The one or more U-channel beams may be structural, insulating, and non-corrosive. The U-channel beam is formed in a “U” shape with a base and two opposing walls forming the U-shaped channel. The first wall and the second wall may have a slight bend inward at the upper tip of each of the walls. This bend helps secure an inserted panel within the channel. The first wall and the second wall of the channel may include at least one protrusion. The protrusion located on the first wall and the second wall help secure wall panels and/or other pieces of the pultruded frame. The U-channel beam may slightly deform when a panel and/or a frame piece is inserted into the channel allowing a friction fit between the opposing projections and the inserted piece. To further secure inserted pieces within the U-channel beam, rubberized gasket type material may be located within the channel of the beam. It is contemplated that the rubberized gasket type material may be located on any surface of the U-channel beam which contacts other elements of the modular building. For example, rubberized gasket material may be located on the protrusions of the first wall and the second wall within the channel. The base of the channel may include one or more protrusions, which provide for a way to space an inserted panel from the base. The hollow space between the inserted wall panel and the base of the channel may be filled with insulation.

[0023] The frame may include one or more closeout connectors. The frame may include one or more, two or more, three or more, four or more, or even five or more close out connectors. The one or more closeout connectors attach to open channels along the

outside of the frame, providing a cleaner and more finished look to the modular building as well as providing another insulated structure to the modular building. The one or more closeout connectors may be generally hollow structures. It is contemplated that the hollow portions of the closeout connector may be filled with an insulating material. The one or more closeout connectors may be used in conjunction with one or more T-connection beams where the T-connection beam only has two of its three channels filled. A closeout connector is adapted to fit within any unfilled channel of the T-connection beam.

[0024] The pultruded frame of the modular building is formed to hold the wall and roof panels in place, creating the structure of the building. The modular building may employ multiple wall panels and multiple roof panels. The wall panels and the roof panels may be made of dissimilar materials. For example, the wall panels may be a pultruded polymeric material and the roof panels may be extruded PVC or extruded aluminum. In another example, the wall panels may be made of extruded PVC or extruded aluminum and the roof panels may be made of a pultruded polymeric material. The wall panels and the roof panels may be made of the same material. For example, the wall panels and the roof panels may be made of pultruded polymeric material. The pultruded polymeric material may be a thermoset material or a thermoplastic material. The pultruded polymeric material may include one or more fibers which may be selected from carbon fibers, glass fibers, thermoplastic epoxy fibers or other polymeric fibers. The polymeric material may comprise a polyurethane-based composition. The polymeric material may comprise a thermoplastic epoxy-based composition. The pultruded components may include one or more of a fibrous layer, a film layer, and an adhesive layer. Any adhesive utilized in the building components may be a reformable adhesive (e.g., a reformable thermoplastic resin material) or a structural adhesive. The adhesive may be activated by contact with a heat source or may contain a metal to be activated by induction.

[0025] The wall panels and the roof panels may be generally hollow structures. They may be generally solid structures. The wall panels and the roof panels may include reinforcing C-channel beams located within the panels in order to provide extra reinforcement. The reinforcing C-channel beams may be made of pultruded polymeric material, steel, or any other suitable reinforcing material. Additionally, the wall panels

and the roof panels may also be filled with an insulating material. The insulating material may include a non-woven material which may be lofted or thermoformed. The insulating material may be an expanding foam material. The wall panels and the roof panels are adapted to fit within the frame pieces of the modular building system.

[0026] Figure 1 shows a perspective view of the modular building 1 assembled. The modular building includes T-shaped connectors 2, wall-to-roof connection beams 4, U-channel pieces 6, closeout connectors 8, wall panels 12, and roof panels 10. The U-channel pieces 6 are located at the base of the building with wall panels 12 inserted in the U-channel pieces 6. The wall panels 12 are connected to each other by the T-shaped connectors 2. At the ends of the modular building 1, it can be seen that the closeout connectors 8 are attached to the T-shaped connectors 2 on the exterior portion which are not engaging a wall panel 12 or a roof panel 10. Connecting the roof panels 10 to the wall panels 12 requires the wall-to-roof connection beams 4. The wall-to-roof connection beams attach to the top end of the wall panels 12 and the bottom end of the roof panels 10.

[0027] Figure 2 shows a cross sectional view of a wall-to-roof connection beam 4. The wall-to-roof connection beam 4 includes a first flange 14 and a second flange 16, connected by the connection portion 18. The first flange 14 is inclined at generally the same angle as the roof panel which it will connect to. The second flange 16 serves as the endstop of a channel formed by a first wall 20 and a second wall 22. The channel is adapted to accept the top portion of the wall panels (not shown). The first wall 20 and the second wall 22 include protrusions 24. Matching the angle of the first flange 14, the wall-to-roof connection beam includes an inclined member 26 which extends towards and beyond the second flange 16. The inclined member 26 includes a cutaway which forms a small channel 28.

[0028] Figure 3 shows a cross sectional view of a T-shaped connector 2. The T-shaped connector includes a generally hollow body 30. The body 30 includes three channels: a first channel 32, a second channel 34, and a third channel 36. The first channel 32 and the second channel 34 are aligned along the same axis and are parallel to each other. The third channel 36 is perpendicular to the first channel 32 and the second channel 34. Each

of the channels 32, 34, 36 include protrusions 38 which help attach the T-shaped connector 2 with wall panels, roof panels, frame members, or a combination thereof.

[0029] Figure 4 is a cross sectional view of the U-channel piece 6. The U-channel piece 6 includes a base 40, a first wall 42, and a second wall 44. The first wall 42 and the second wall 44 both include inwardly bent tips 46 and protrusions 48 which are used to help secure wall panels when inserted. The base 40 includes base protrusions 50 which create a space between the base 40 and a wall panel when the wall panel is inserted into the U-channel piece 6.

[0030] Figure 5 is a cross sectional view of a wall panel 10 / roof panel 12. The panel 10,12 includes a body 60. The body 60 includes a first end 62 and a second end 64. The body 60 maintains its shape through the use of the structural reinforcements 66. For additional reinforcement, the body 60 may include a U-shaped reinforcement between the structural reinforcements 66. The first end 62 is adapted to slide into the channels of the various frame pieces, and the second end 64 is formed as a channel to accept the various frame pieces.

[0031] Figure 6 is a cross sectional view of a closeout connector 8. The closeout connector 8 has a body 80 with a top side 82 and a bottom side 84. The top side 82 is flat. The bottom side 84 is also flat but has an open channel 86 formed in the middle of the bottom side 84. The body 80 also includes a first end 88 and a second end 90 which both taper from the top side 82 and the bottom side 84 ending at identical channels 92. The channels 92 allow the closeout connector to be inserted and held into the various frame members.

[0032] As used herein, unless otherwise stated, the teachings envision that any member of a genus (list) may be excluded from the genus; and/or any member of a Markush grouping may be excluded from the grouping.

[0033] Unless otherwise stated, any numerical values recited herein include all values from the lower value to the upper value in increments of one unit provided that there is a separation of at least 2 units between any lower value and any higher value. As an example, if it is stated that the amount of a component, a property, or a value of a process variable such as, for example, temperature, pressure, time and the like is, for example, from 1 to 90, preferably from 20 to 80, more preferably from 30 to 70, it is intended that

intermediate range values such as (for example, 15 to 85, 22 to 68, 43 to 51, 30 to 32 etc.) are within the teachings of this specification. Likewise, individual intermediate values are also within the present teachings. For values which are less than one, one unit is considered to be 0.0001, 0.001, 0.01, or 0.1 as appropriate. These are only examples of what is specifically intended and all possible combinations of numerical values between the lowest value and the highest value enumerated are to be considered to be expressly stated in this application in a similar manner. As can be seen, the teaching of amounts expressed as "parts by weight" herein also contemplates the same ranges expressed in terms of percent by weight. Thus, an expression in the of a range in terms of at "'x' parts by weight of the resulting polymeric blend composition" also contemplates a teaching of ranges of same recited amount of "x" in percent by weight of the resulting polymeric blend composition."

[0034] Unless otherwise stated, all ranges include both endpoints and all numbers between the endpoints. The use of "about" or "approximately" in connection with a range applies to both ends of the range. Thus, "about 20 to 30" is intended to cover "about 20 to about 30", inclusive of at least the specified endpoints.

[0035] The disclosures of all articles and references, including patent applications and publications, are incorporated by reference for all purposes. The term "consisting essentially of" to describe a combination shall include the elements, ingredients, components or steps identified, and such other elements ingredients, components or steps that do not materially affect the basic and novel characteristics of the combination. The use of the terms "comprising" or "including" to describe combinations of elements, ingredients, components or steps herein also contemplates embodiments that consist of, or consist essentially of the elements, ingredients, components or steps.

[0036] Plural elements, ingredients, components or steps can be provided by a single integrated element, ingredient, component or step. Alternatively, a single integrated element, ingredient, component or step might be divided into separate plural elements, ingredients, components or steps. The disclosure of "a" or "one" to describe an element, ingredient, component or step is not intended to foreclose additional elements, ingredients, components or steps.

[0037] It is understood that the above description is intended to be illustrative and not restrictive. Many embodiments as well as many applications besides the examples provided will be apparent to those of skill in the art upon reading the above description. The scope of the invention should, therefore, be determined not with reference to the above description, but should instead be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. The disclosures of all articles and references, including patent applications and publications, are incorporated by reference for all purposes. The omission in the following claims of any aspect of subject matter that is disclosed herein is not a disclaimer of such subject matter, nor should it be regarded that the inventors did not consider such subject matter to be part of the disclosed inventive subject matter.

CLAIMS

What is claimed is:

Claim 1: A modular building system including:

- i) a pultruded frame including:
 - a) one or more T-shaped connectors;
 - b) one or more wall-to-roof connection beams; and
 - c) one or more U-channel pieces;
- ii) one or more wall panels; and
- iii) one or more roof panels;

wherein the pultruded frame connects and holds the one or more wall panels and the one or more roof panels forming a modular building.

Claim 2: The modular building system of claim 1, wherein the one or more wall panels are formed from a pultruded thermoset material.

Claim 3: The modular building system of claim 1 or claim 2, wherein the one or more roof panels are formed from a pultruded thermoset material.

Claim 4: The modular building system of any of the preceding claims, wherein the pultruded frame is filled with an expandable foam insulation.

Claim 5: The modular building system of any of the preceding claims, wherein the pultruded frame connects the one or more walls and the one or more roof panels with a rubberized gasket seal.

Claim 6: The modular building system of any of the preceding claims, wherein the pultruded frame further includes one or more closeout connectors.

Claim 7: The modular building system of claim 6, wherein the one or more closeout connectors are connected to pieces of the pultruded frame that have a free channel and are located on an exterior of the modular building.

Claim 8: The modular building system of any of the preceding claims, wherein the one or more U-channel pieces form a base of the pultruded frame.

Claim 9: The modular building system of any of the preceding claims, wherein the one or more U-channel pieces connect to a bottom portion of the one or more wall panels.

Claim 10: The modular building system of any of the preceding claims, wherein the one or more T-shaped connection beams have at least two channels.

Claim 11: The modular building system of any of the preceding claims, wherein the one or more T-shaped connection beams have at least three channels.

Claim 12: The modular building system of claim 10, wherein each one of the at least two channels accepts one of the one or more wall panels, one of the one or more roof panels, or a piece of the pultruded frame.

Claim 13: The modular building system of claim 11, wherein each one of the at least three channels accepts one of the one or more wall panels, one of the one or more roof panels, or a piece of the pultruded frame.

Claim 14: The modular building system of any of the preceding claims, wherein the one or more wall-to-roof connection beams connect the one or more wall panels with the one or more roof panels.

Claim 15: The modular building system of any of the preceding claims, wherein the one or more wall panels include one or more steel reinforcing pieces located within the one or more wall panels.

Claim 16: The modular building system of any of the preceding claims, wherein the one or more roof panels include one or more steel reinforcing pieces located within the one or more roof panels.

Claim 17: The modular building system of any of the preceding claims, wherein the one or more wall panels and the one or more roof panels are made from the same material.

Claim 18: The modular building system of any of the preceding claims, wherein the one or more wall panels and the one or more roof panels are made from dissimilar materials.

Claim 19: The modular building system of any of the preceding claims, wherein one or more parts of the pultruded frame comprise a polyurethane-based pultruded material.

Claim 20: The modular building system of any of the preceding claims, wherein one or more components of the pultruded frame comprise thermoplastic epoxy-based pultruded material.

Claim 21: The modular building system of any of the preceding claims, wherein one or more wall panels and/or one or more roof panels are contacted with a sound-absorption comprising a lofted non-woven material.

Claim 22: The modular building system of any of the preceding claims, wherein one or more wall panels and/or one or more roof panels are contacted with a sound-absorption comprising a thermoformed non-woven material.

Claim 23: The modular building system of any of the preceding claims, wherein one or more wall panels and/or one or more roof panels are contacted with an adhesive film material.

Claim 24: The modular building system of any of the preceding claims, wherein one or more components of the pultruded frame comprise an adhesive film material.

Claim 25: The modular building system of claim 23 or claim 24, wherein the adhesive film comprises a thermoplastic epoxy material.

Claim 26: The modular building system of claim 23 or claim 24, wherein the adhesive film comprises a thermoset structural adhesive material.

Claim 27: The modular building system of any of the preceding claims, wherein one or more components of the pultruded frame comprise one or more pultruded fibers.

Claim 28: The modular building system of claim 27, wherein the one or more pultruded fibers are selected from carbon fibers, glass fibers, or thermoplastic epoxy fibers.

Claim 29: The modular building system of any of the preceding claims, wherein one or more components of the pultruded frame are curved pultruded members.

Claim 30: The modular building system of any of the preceding claims, wherein one or more components of the pultruded frame are contacted by a foamable sealing material.

Claim 31: The modular building system of any of the preceding claims, wherein one or more components of the pultruded frame are contacted by an injection molded polymeric component.

Claim 32: The modular building system of claim 31, wherein the injection molded polymeric component comprises a polyamide material.

Claim 33: The modular building system of claim 31, wherein the injection molded polymeric component comprises a glass-filled material.

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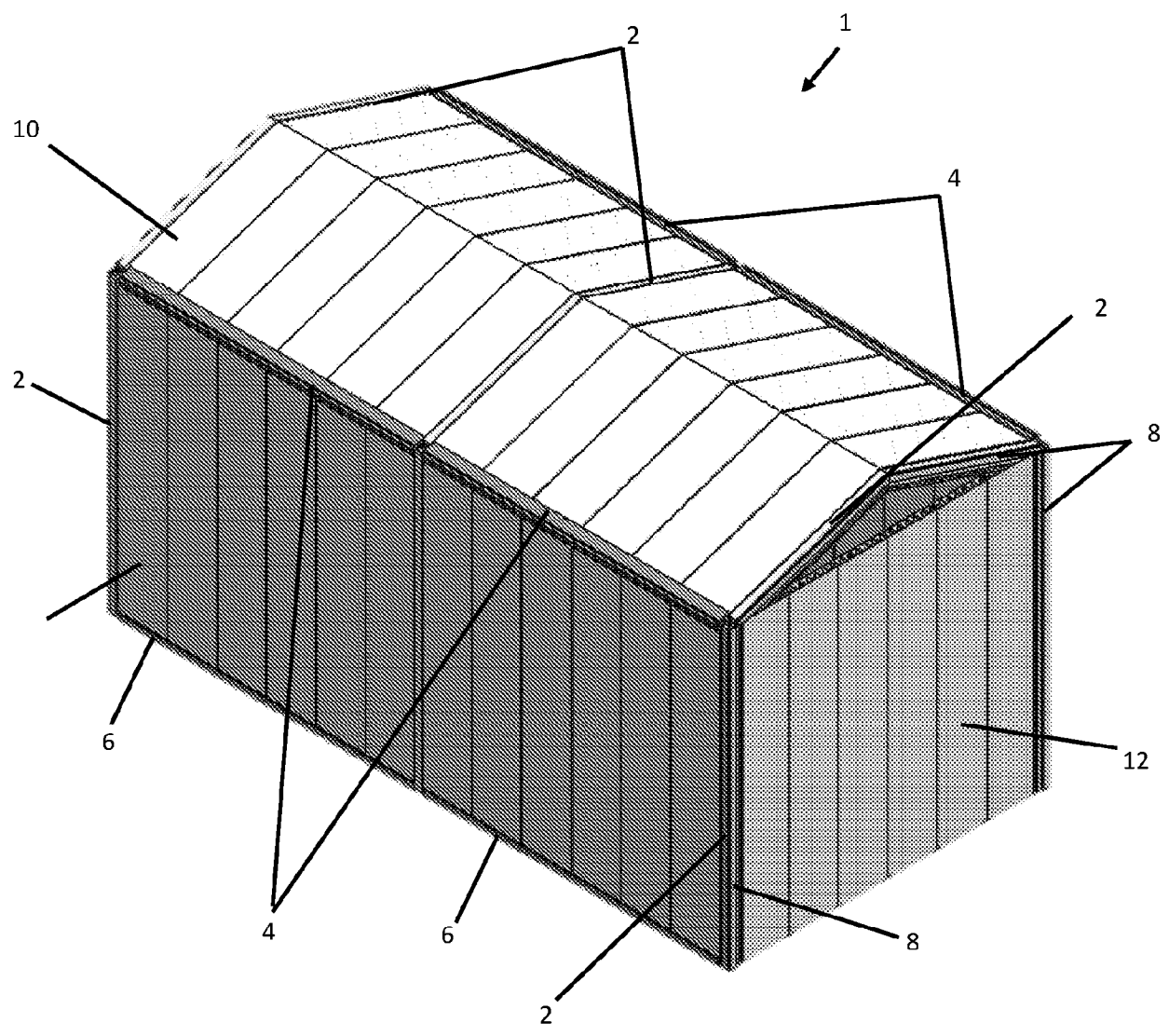


FIG. 1

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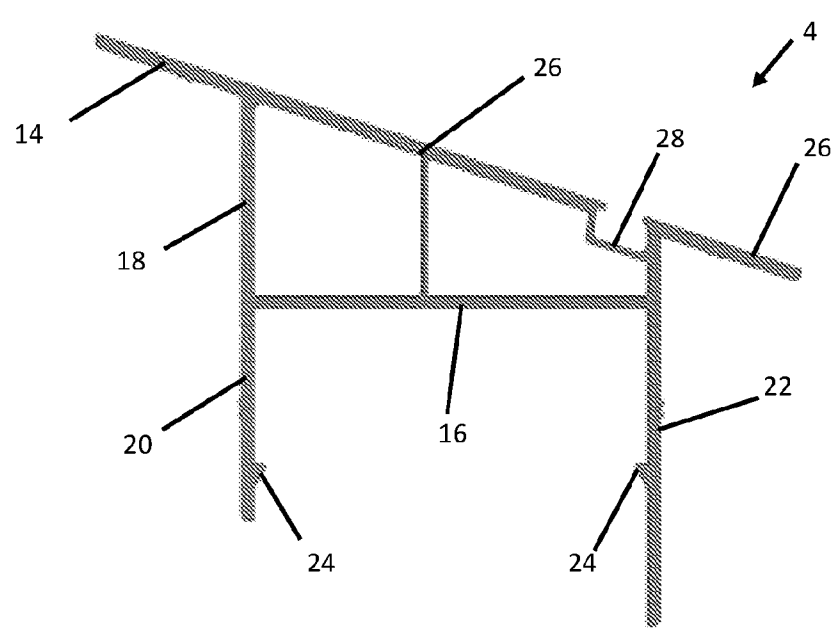


FIG. 2

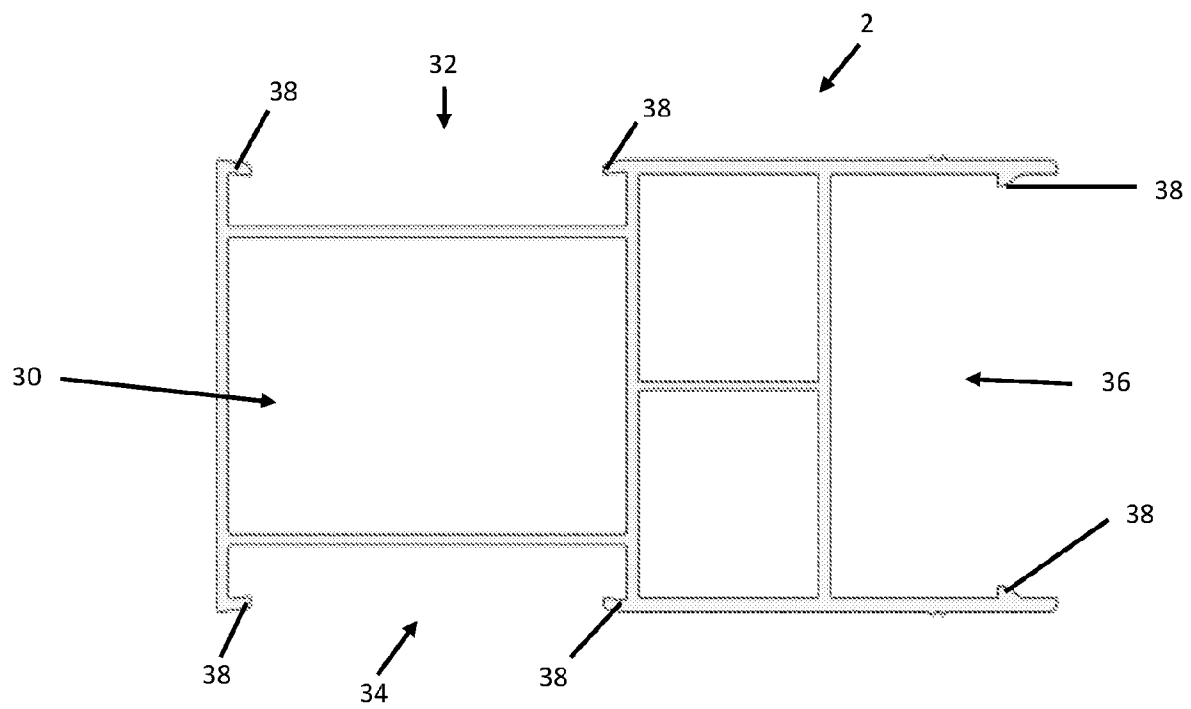
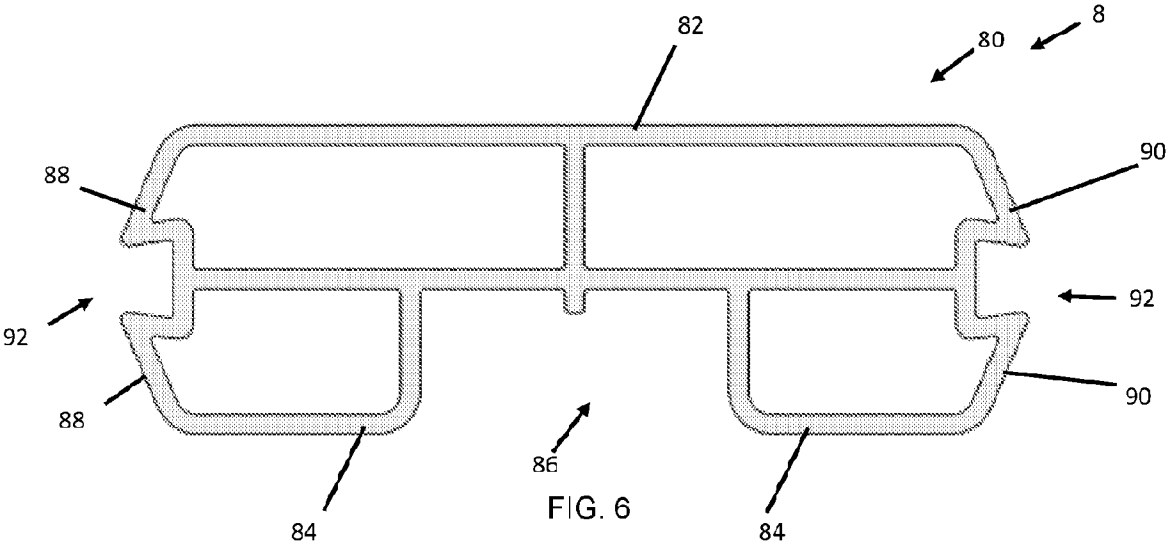
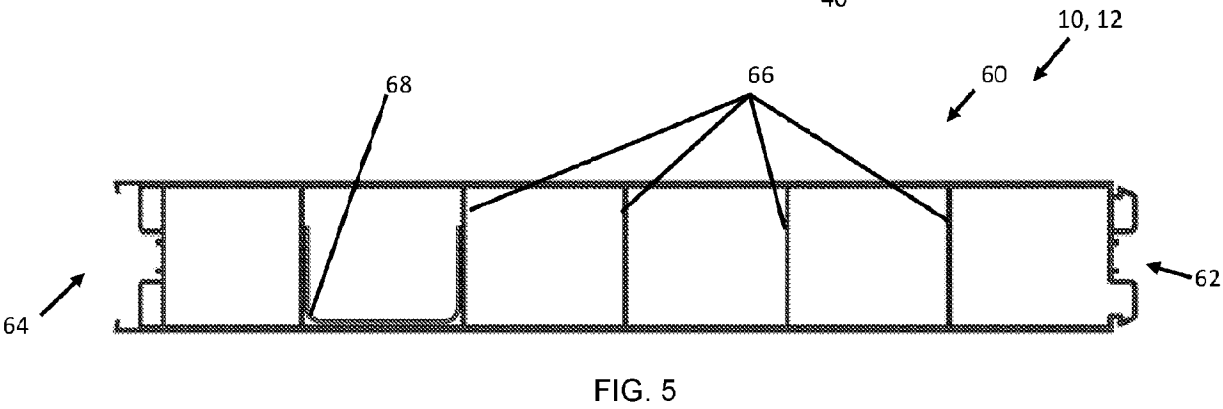
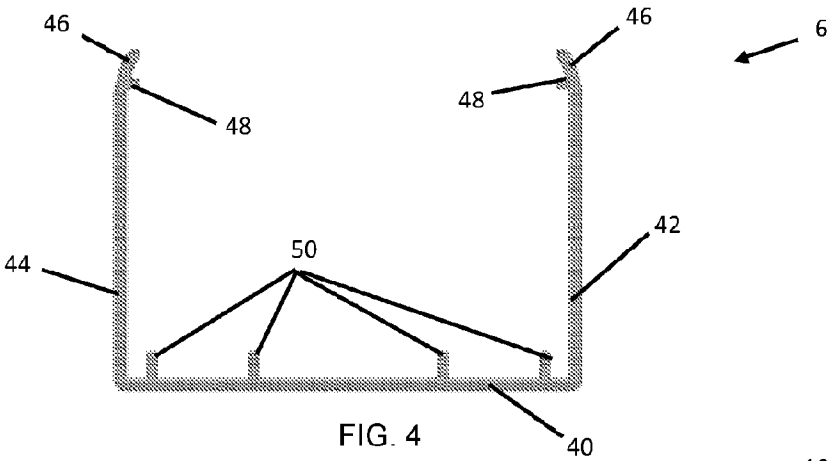


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/056481

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04B1/28
ADD. E04B1/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 092 340 A (SIMMONS DAVID G [US]) 25 July 2000 (2000-07-25) column 5, line 47 - column 10, line 67; figures 1, 6, 8, 9, 10, 17, 22, 27 -----	1-33
X	US 2012/011798 A1 (RIVELLINO ERNEST [US]) 19 January 2012 (2012-01-19) paragraph [0044] - paragraph [0058]; figures 1-22 -----	1-33



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search

28 January 2019

Date of mailing of the international search report

13/02/2019

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/056481

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6092340	A	25-07-2000	AU 2371300 A 03-07-2000
			US 6092340 A 25-07-2000
			WO 0036237 A1 22-06-2000

US 2012011798	A1	19-01-2012	NONE
