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(54) **WALL CONSTRUCTION WITH LAMINATED INSULATION PANELS AND SPACER BOARDS FORMING INSULATIVE AIR-FILLED VOIDS**

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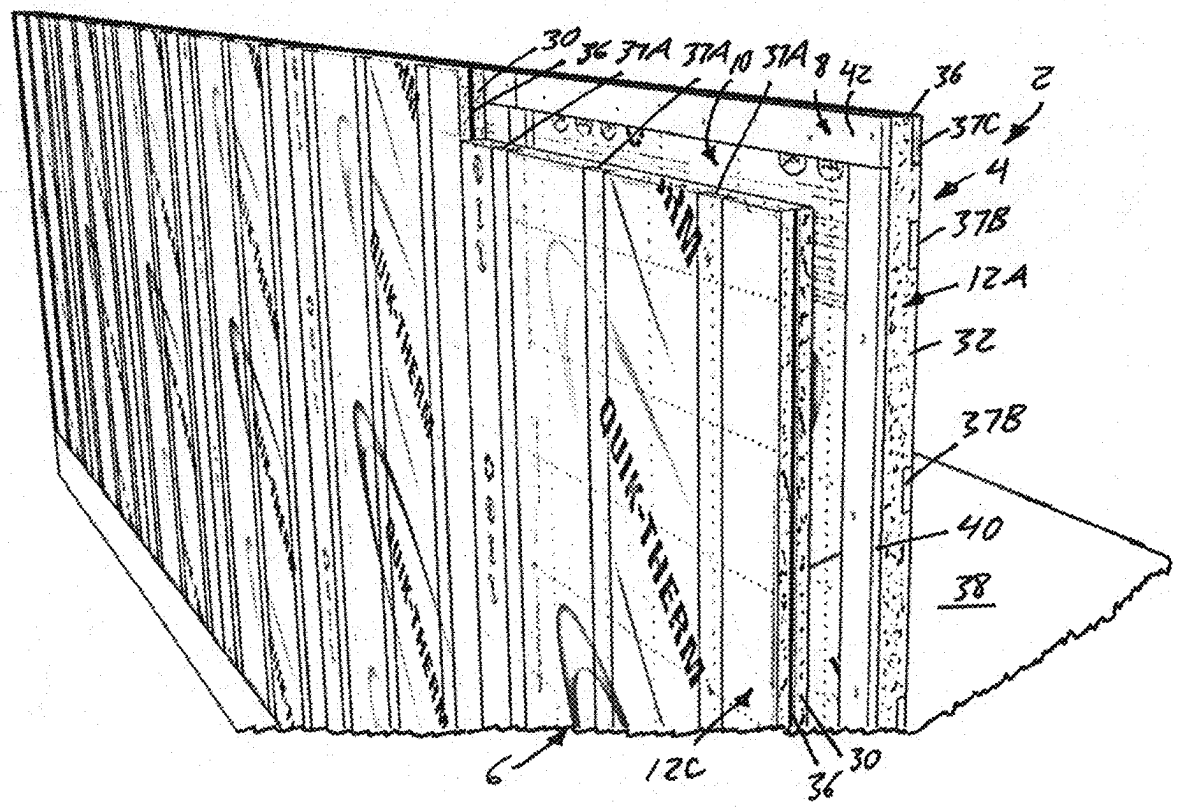
CPC ***E04B 1/7608*** (2013.01); ***E04B 1/80*** (2013.01)

(57) **ABSTRACT**

An exterior wall features interior and exterior insulation layers that comprise facer-laminated foam insulation panels having battens recessed into foam cores thereof at interior and exterior faces of the interior and exterior layers, respectively. An intermediate layer installed between the interior and exterior insulation layers provide additional insulative effect. At the interior side of the interior panels, an interior set of spacer boards are installed for offset mounting of interior finishings (e.g. drywall) thereto, thereby creating an interior-adjacent array of air-filled void spaces between the interior insulation panels and the interior finishings. Exterior cladding placed directly over the exterior insulation panels is fastened to the battens thereof. On-site construction with a framing nailer is fast and convenient, creating a thermally efficient wall without need for batting insulation, poly sheeting vapour barrier, building wrap or exterior sheathing.



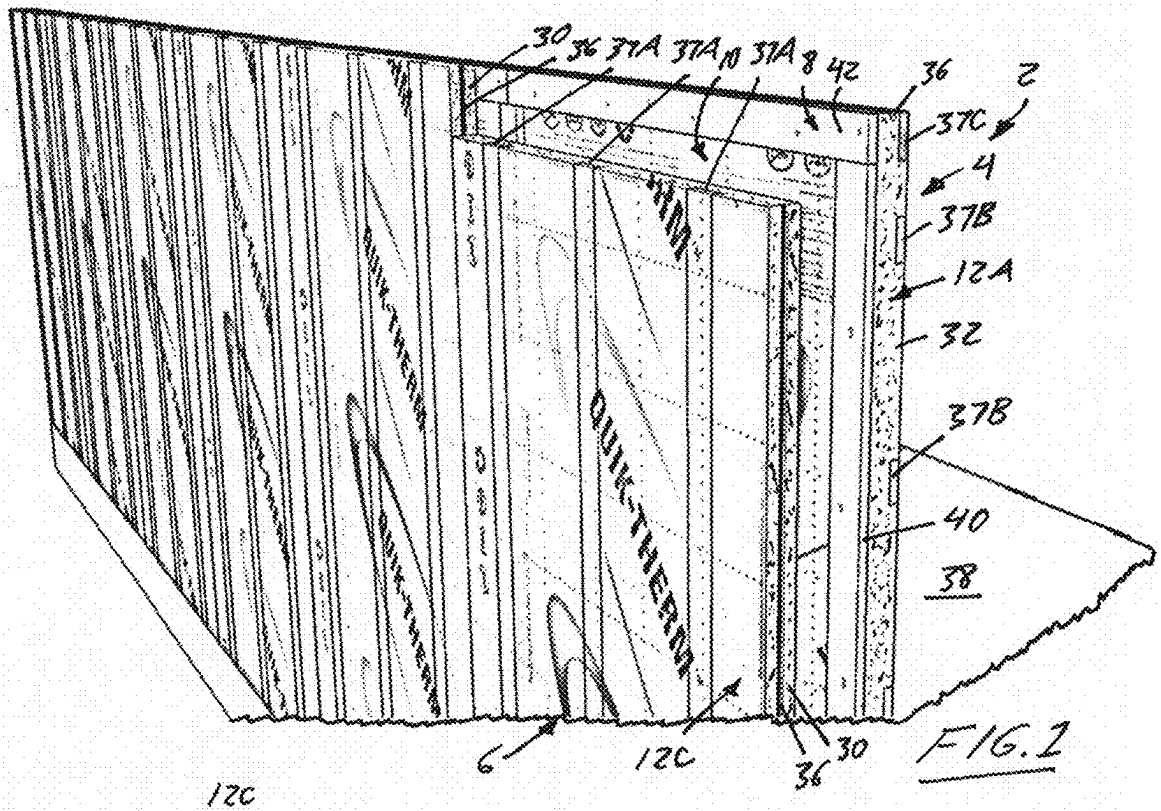

30
36
37A
37A
37A
42
36
2
37C
4
37B
12A
32
37B
40
38
QUIK-THERM
6
12C
36
30

FIG. 1

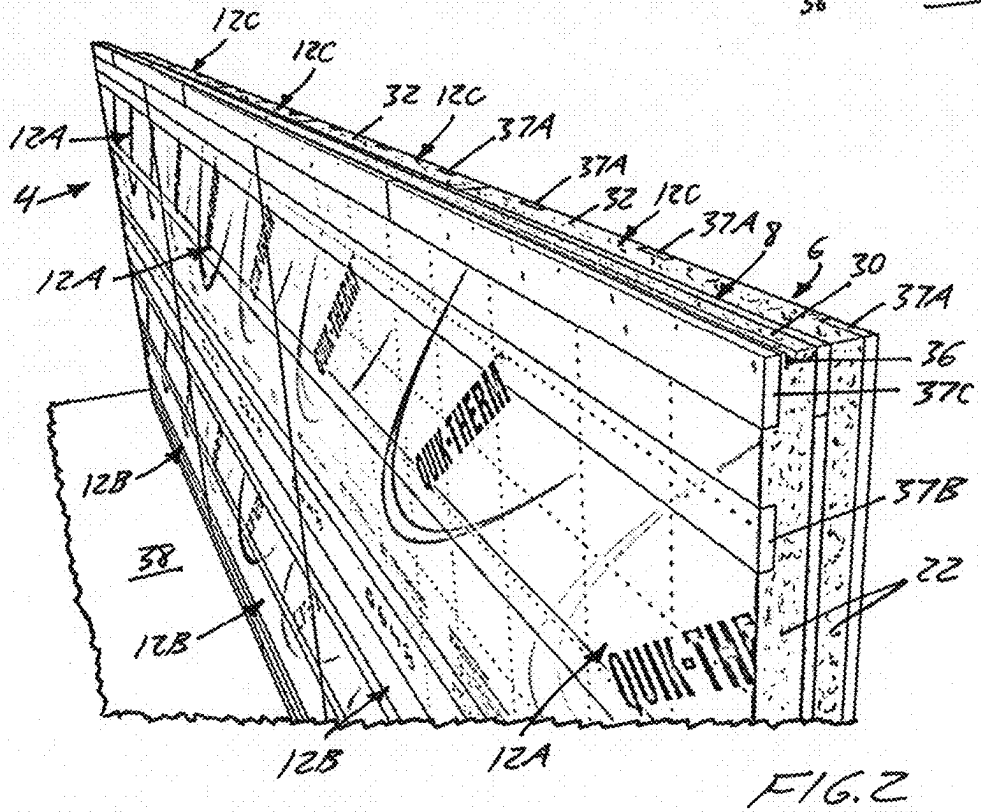

12C
12C
32
12C
37A
37A
32
12C
37A
8
6
30
37A
36
37C
12A
4
12A
12B
38
12B
12B
12A
QUIK-THERM
22

FIG. 2

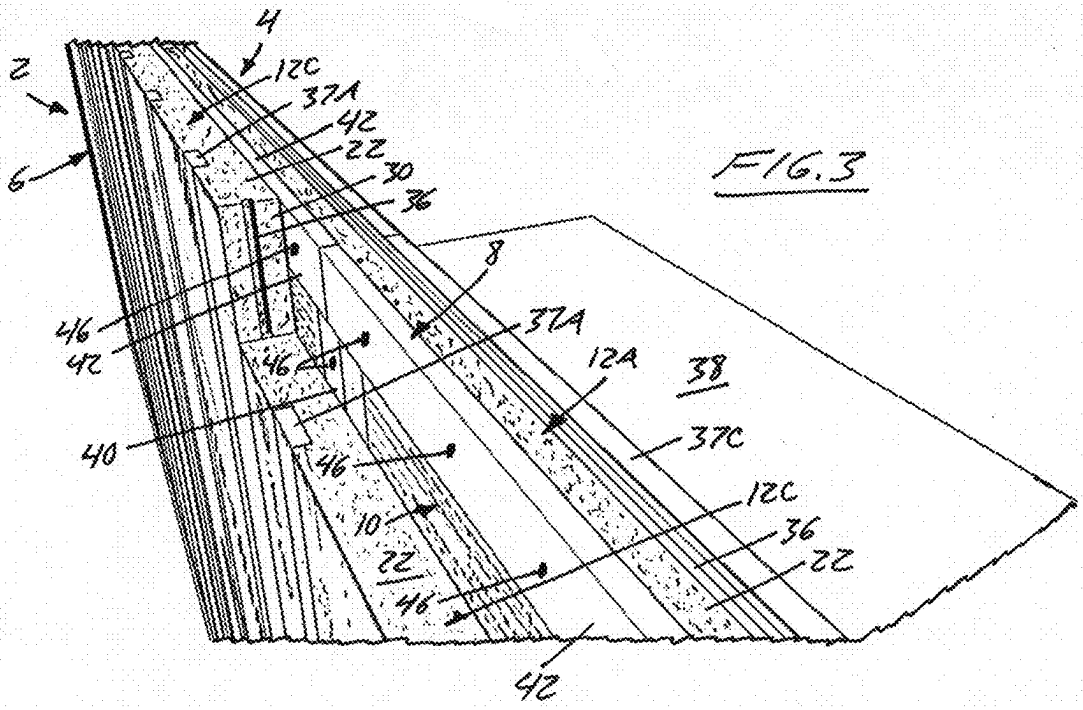

2
4
6
12C
37A
42
22
30
36
8
46
42
40
37A
12A
38
37C
12C
36
22
10
22
46
42

FIG. 3

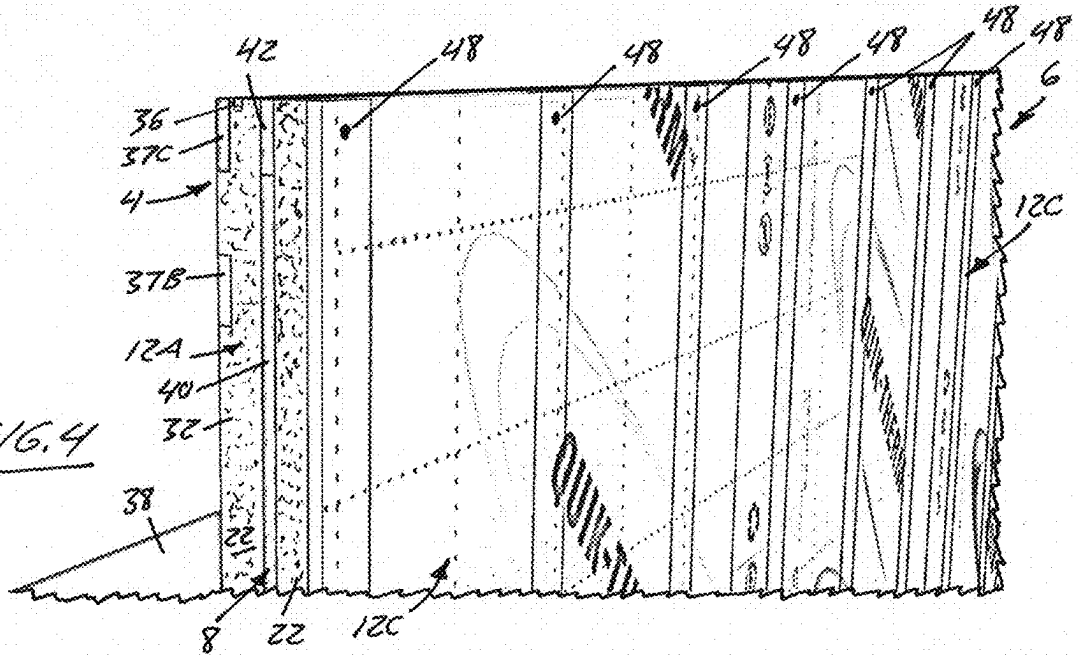

42
48
48
48
48
48
48
6
36
37C
4
12C
37B
12A
40
32
38
22
8
22
12C

FIG. 4

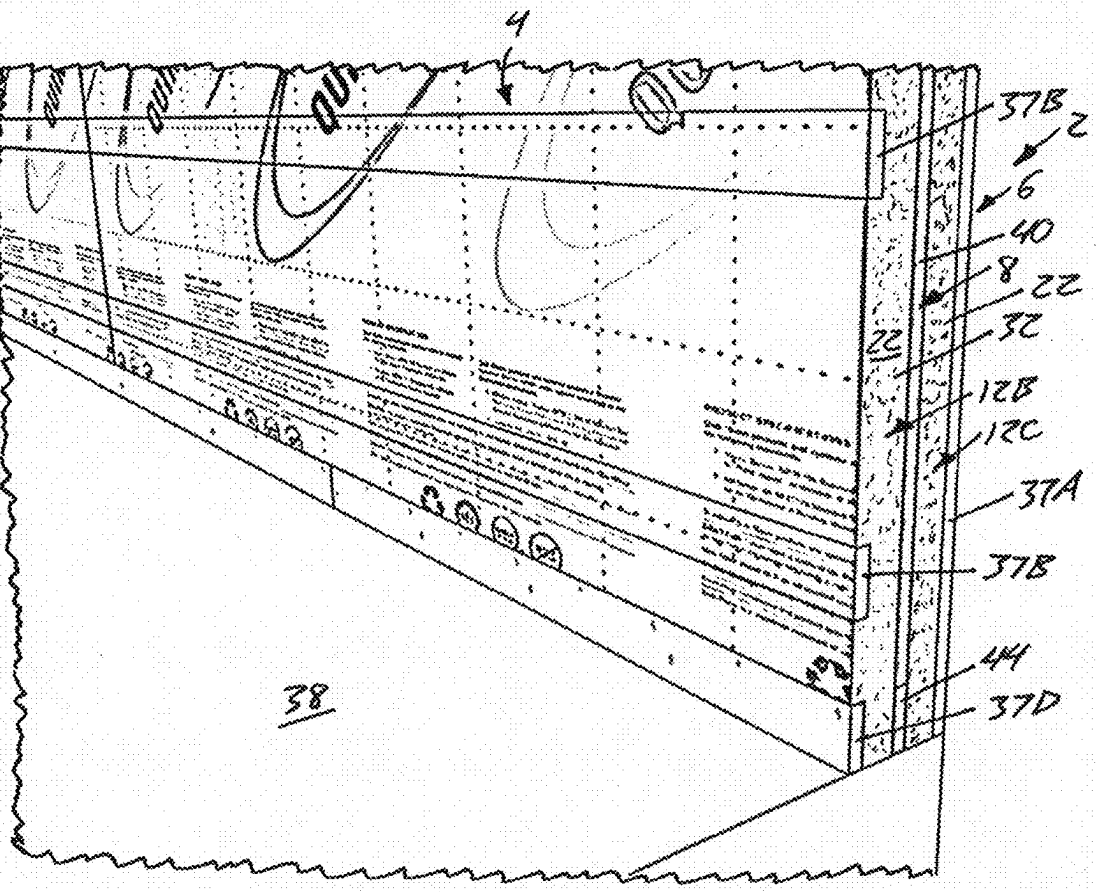

4
37B
2
6
40
8
22
32
22
12B
12C
37A
37B
44
37D
38

FIG. 5

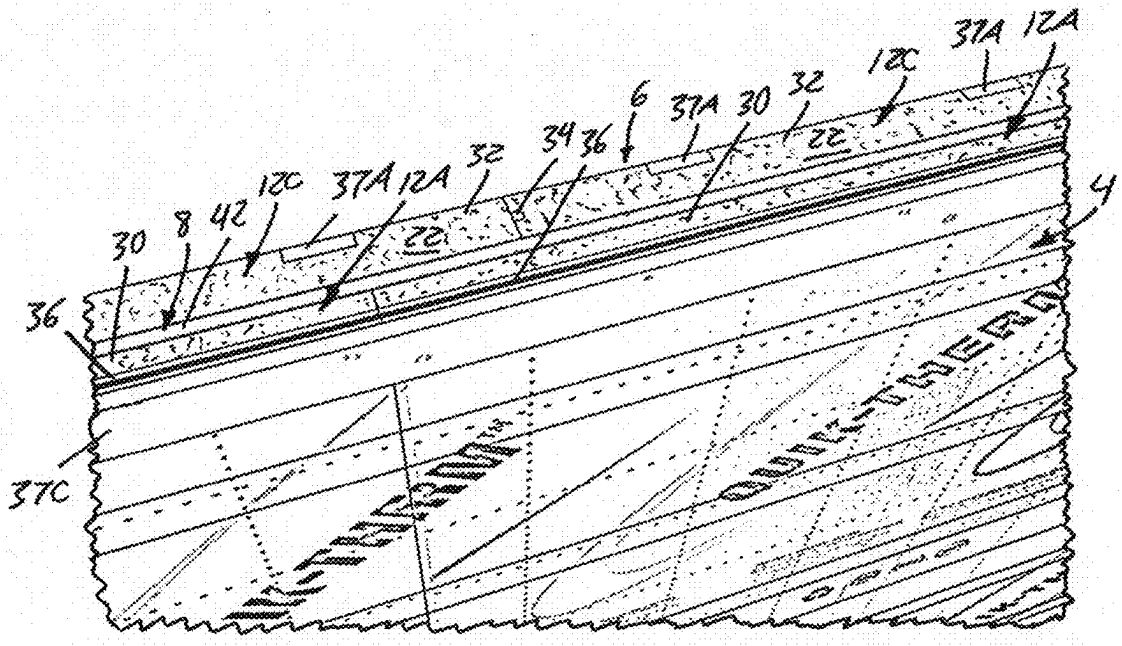

37A
12A
12C
32
6
37A
30
34
36
22
30
8
42
12C
37A
12A
32
22
4
36
37C

FIG. 6

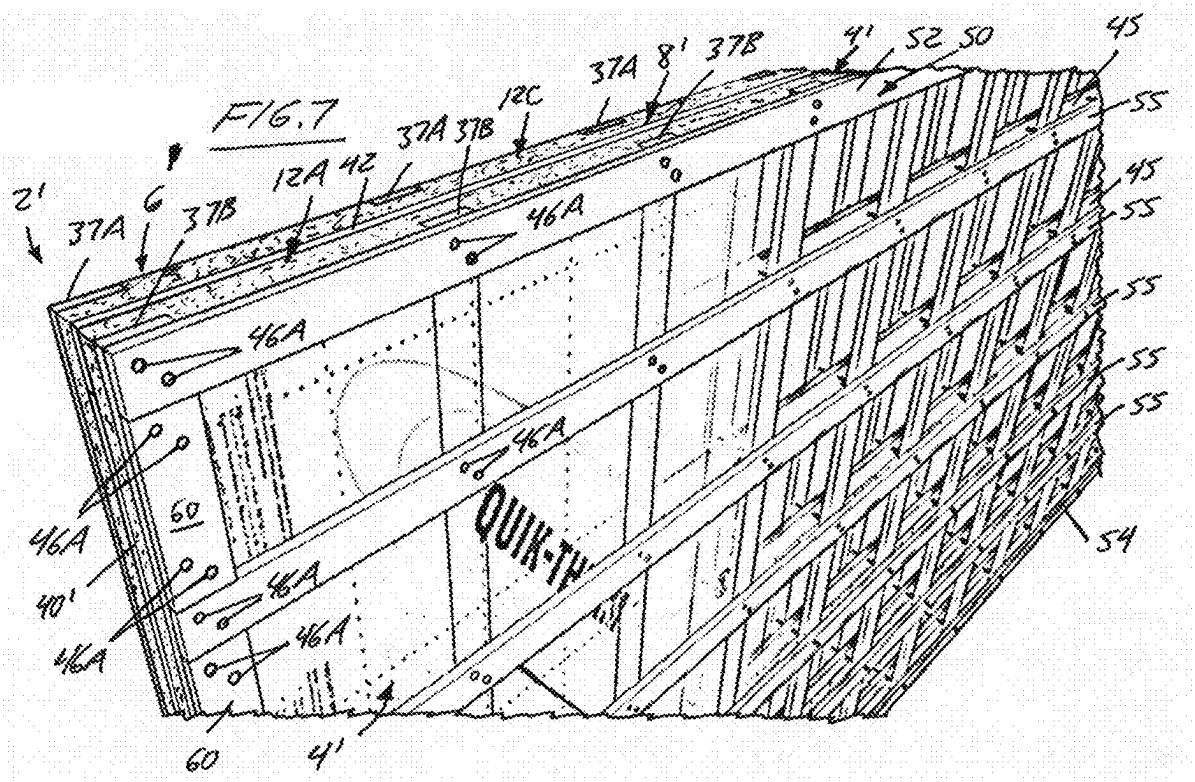


FIG. 7
2'
37A
6
37B
12A
42
37A
37B
12C
37A
8'
37B
4'
52
50
45
55
46A
60
40'
QUIK-TH
54

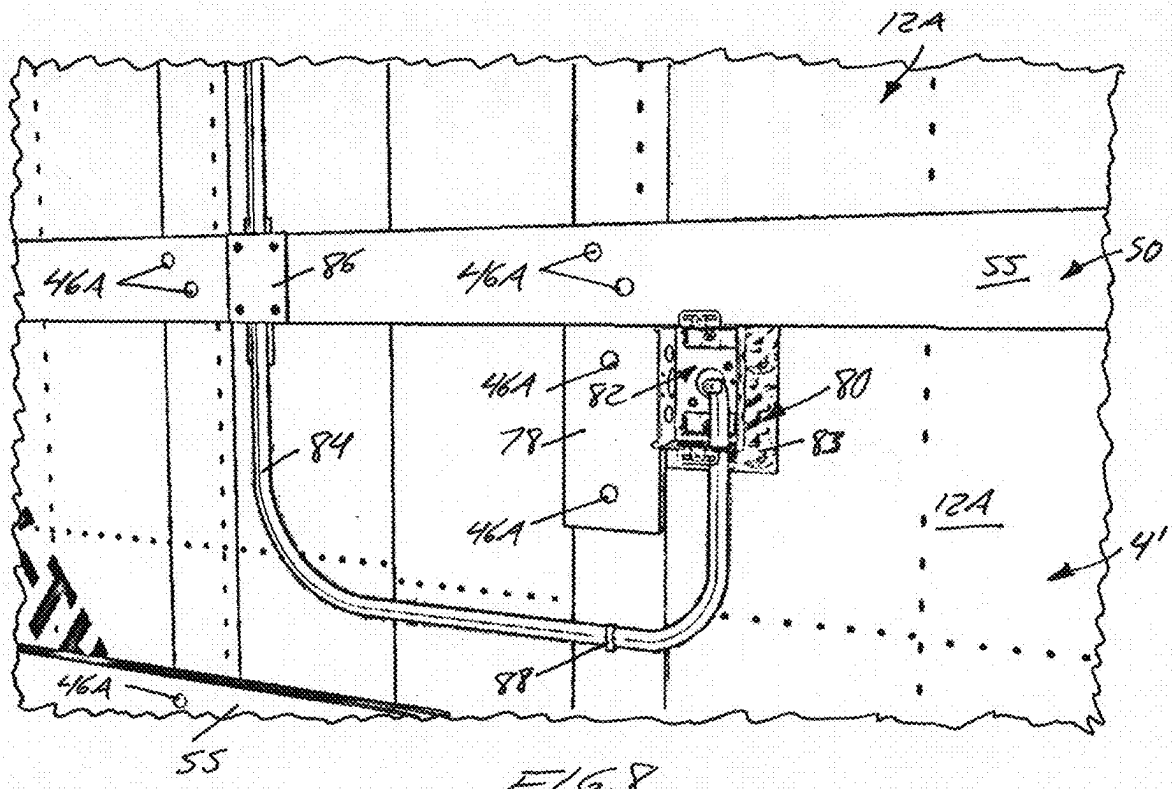
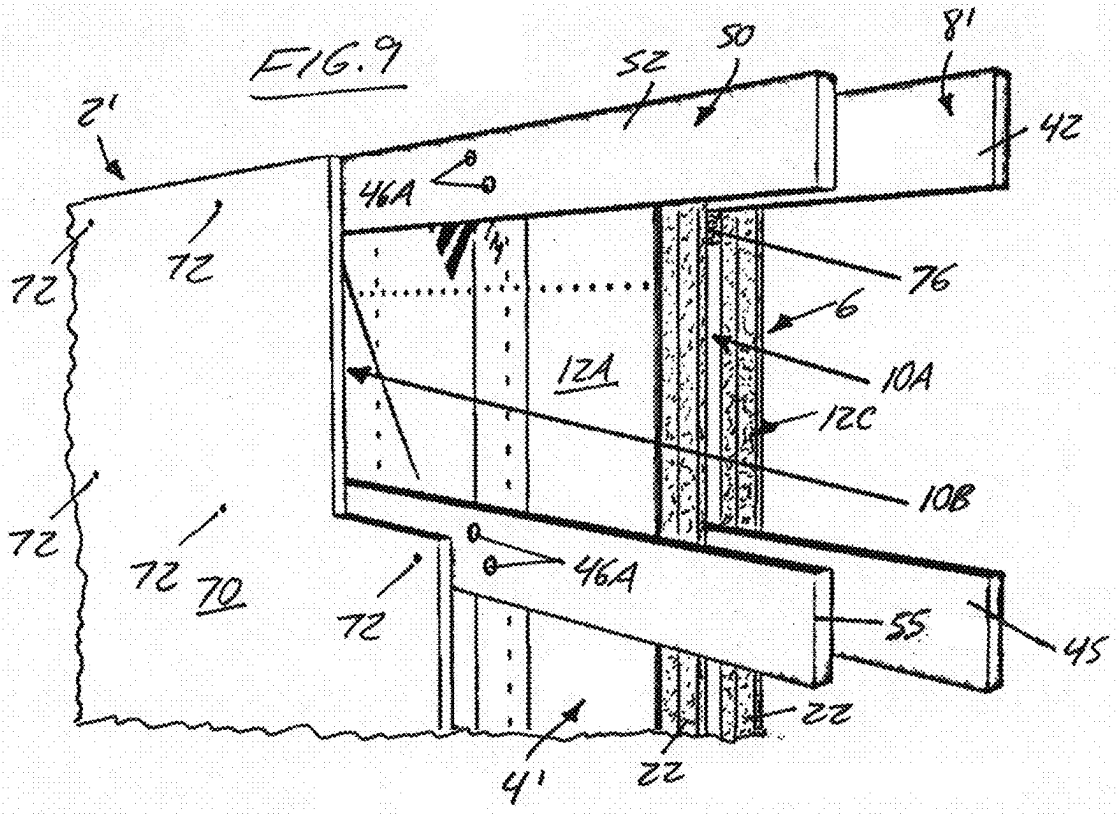

12A
46A
86
46A
55
50
46A
82
80
78
83
84
12A
4'
46A
88
55

FIG. 8

FIG. 9


2'
52
50
8'
42
46A
4'
76
6
72
72
12A
10A
12C
10B
72
72
70
72
46A
55
45
22
4'
22

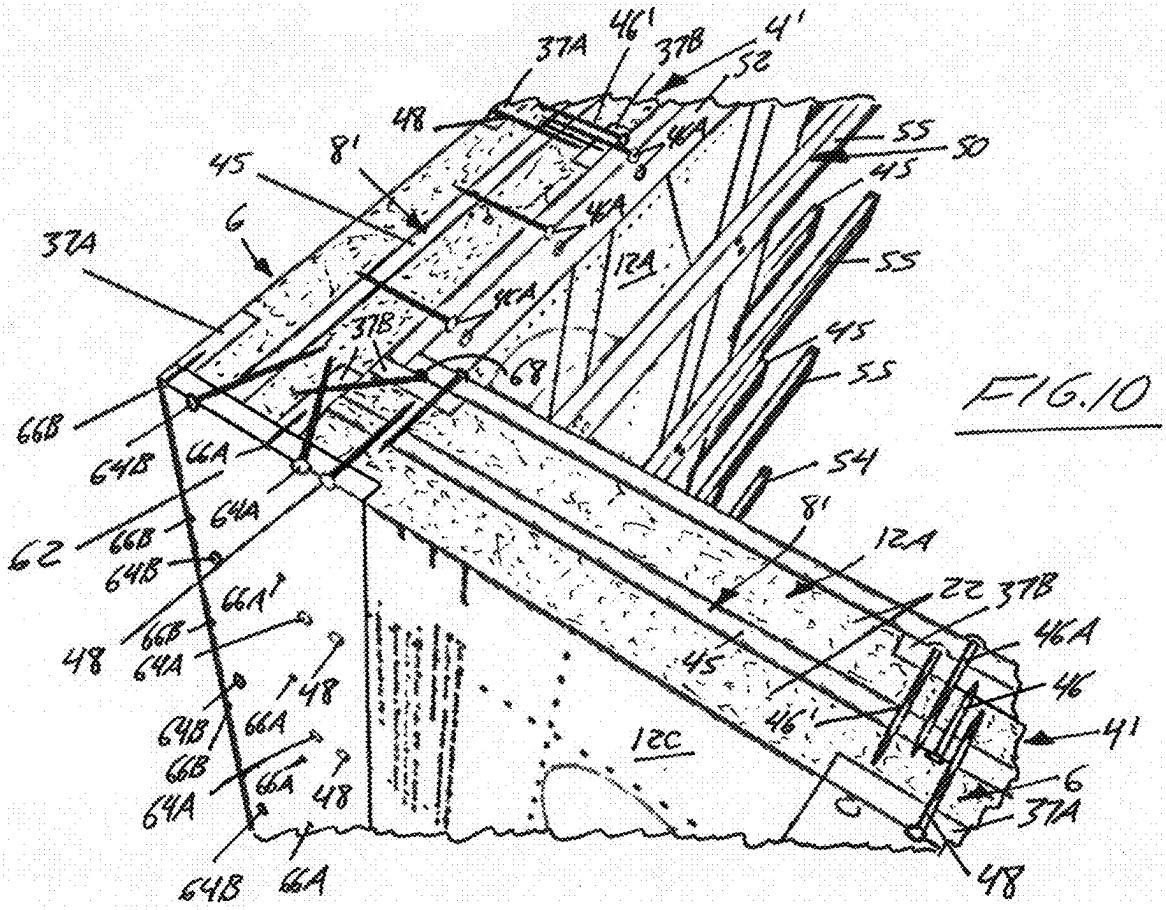

46'
37A
37B
4'
52
48
8'
45
55
50
6
37A
12A
55
37B
45
55
68
66B
64B
66A
54
62
64A
66B
64B
8'
12A
48
66A'
66B
64A
22
37B
46A
48
45
46
64B
66A
48
46'
41'
66B
64A
66A
48
12C
6
37A
64B
66A
48

FIG. 10

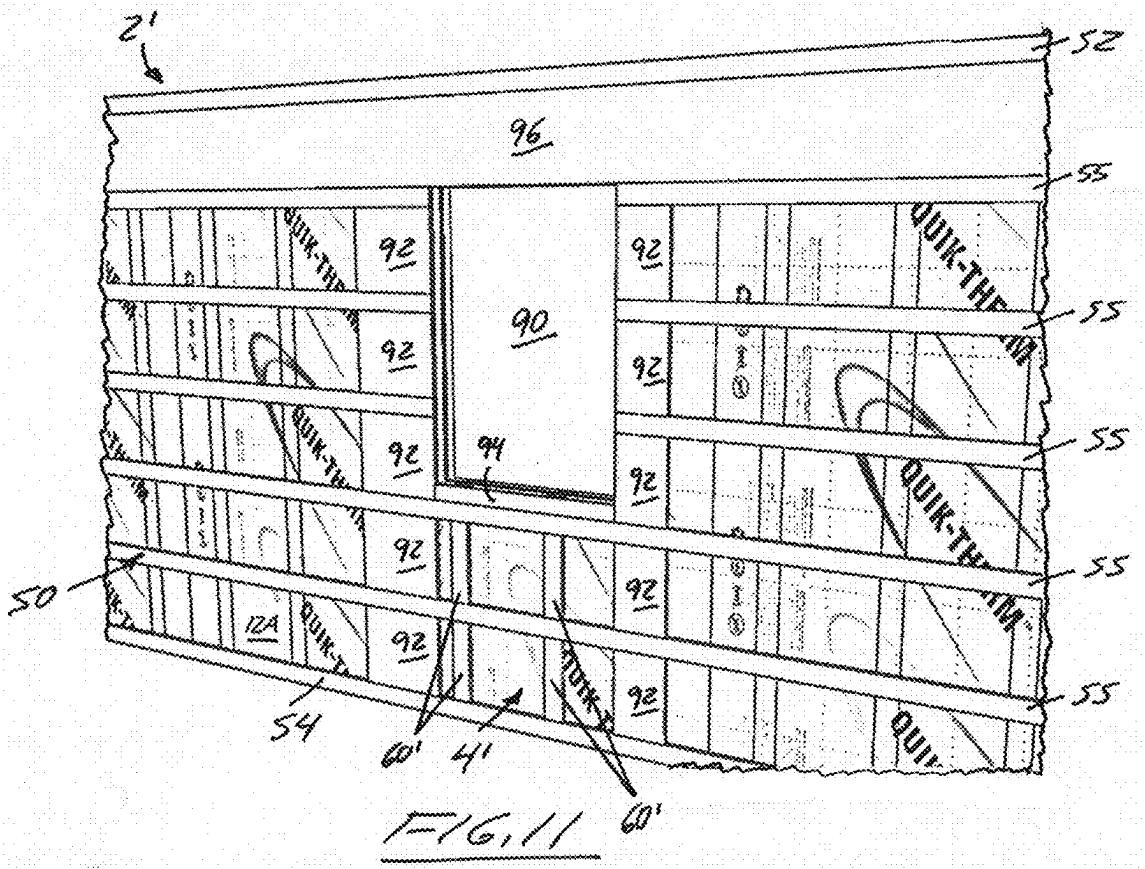
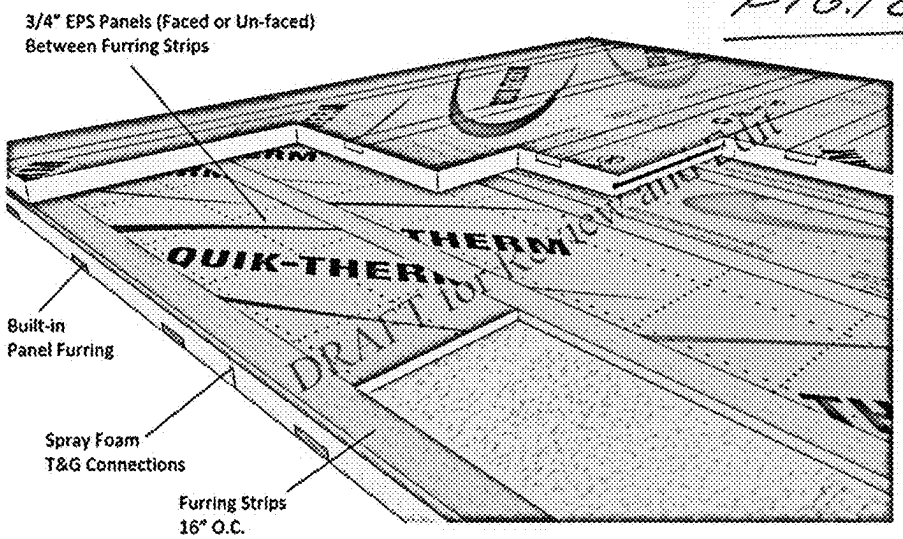

21'
52
96
55
92
90
94
50
12A
54
60'
41'
60'

FIG. 11

FIG. 12


3/4" EPS Panels (Faced or Un-faced)
Between Furring Strips
Built-in
Panel Furring
Spray Foam
T&G Connections
Furring Strips
16" O.C.

WALL CONSTRUCTION WITH LAMINATED INSULATION PANELS AND SPACER BOARDS FORMING INSULATIVE AIR-FILLED VOIDS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of prior U.S. Nonprovisional patent application Ser. No. 17/990,929, filed Nov. 21, 2022, which claims benefit under 35 U.S.C. 119 (e) of U.S. Provisional Application No. 63/282,261, filed Nov. 25, 2021, both of which are incorporated herein by reference in their respective entireties.

FIELD OF THE INVENTION

[0002] This application relates generally to the design and construction of insulated exterior walls of a building.

BACKGROUND

[0003] In general, but particularly in remote northern communities, there exits a notable demand for building materials and construction techniques for producing insulated exterior walls that embody highly insulative properties and suitable structural integrity, yet can be transported, assembled and erected in a time and cost-efficient manner. Disclosed herein is a unique insulated wall construction that Applicant believes can address such demand in a more effective manner than the prior solutions proposed heretofore.

SUMMARY OF THE INVENTION

[0004] According to one aspect of the invention, there is provided a wall assembly comprising:

[0005] interior and exterior insulation layers that respectively comprise interior insulation panels and exterior insulation panels, of which both said interior insulation panels and said exterior insulations each have a foam core, two opposing faces, and plurality of perimeter edges, of which the two opposing faces of each interior insulation panel comprise an interior face that faces away from the exterior insulation layer and an outer face that faces toward the exterior insulation layer, while the two opposing faces of each exterior insulation panel comprise an exterior face that faces away from the interior insulation layer and an inner face that faces toward the interior insulation layer;

[0006] laminated onto the foam core of each of the interior insulation panels and the exterior insulation panels, at least one laminated facer respectively occupying at least one of the two opposing faces thereof;

[0007] a set of interior battens recessed into the foam cores of the interior insulation panels at the interior faces thereof;

[0008] a set of exterior battens recessed into the foam cores of the exterior insulation panels at the exterior faces thereof;

[0009] a set of spacer boards installed in an intermediate layer between the interior and exterior insulation layers;

[0010] a set of interior fasteners by which the interior battens and the spacer boards are interconnected;

[0011] a set of exterior fasteners by which the exterior battens and the spacer boards are interconnected; and

[0012] unoccupied void spaces bound between the spacer boards within the intermediate layer between the interior and exterior insulation panels.

[0013] According to another aspect of the invention, there is provided a method of assembling the wall assembly of any preceding claim, said method comprising:

[0014] laying a first one of either the interior insulation panels or the exterior insulation panels down atop a support in a batten-down orientation;

[0015] laying the spacer boards atop said first one of either the interior insulation panels or the exterior insulation panels, and fastening said spacer boards to the battens of said first one of either the interior insulation panels or the exterior insulation panels thereof through the foam cores thereof;

[0016] laying a second one of either the interior insulation panels or the exterior insulation panels atop the fastened spacer boards in a batten-up orientation, and fastening said second one of either the interior insulation panels or the exterior insulation panels to the fastened spacer boards through the foam cores of said second one of either the interior insulation panels or the exterior insulation panels, whereupon the interior insulation panels, the spacer boards and the exterior insulation panels are now fastened together into an assembled unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Preferred embodiments of the invention will now be described in conjunction with the accompanying drawings in which:

[0018] FIG. **1** is a perspective view of an assembled exterior wall constructed in accordance with a first embodiment of the present invention, as viewed from an exterior side thereof, and with an exterior insulation layer of the wall partially cut away at one end thereof.

[0019] FIG. **2** is another perspective view of the assembled exterior wall of FIG. **1** from an opposing interior side thereof.

[0020] FIG. **3** is a partial top perspective view of the assembled exterior wall of FIG. **1**, as viewed from the exterior side thereof near the partially cut away end thereof.

[0021] FIG. **4** is an end perspective view of the assembled exterior wall of FIG. **1**, as again viewed from the exterior side thereof, but at an opposing end thereof, and with focus on an upper region of the wall's height.

[0022] FIG. **5** is another end perspective view of the assembled exterior wall of FIG. **4**, as viewed at the same end thereof, but from the interior side thereof with focus on a lower region of the wall's height.

[0023] FIG. **6** is another partial top perspective view of the assembled exterior wall of FIG. **3**, but viewed from the interior side thereof at a mid-region of the wall's width.

[0024] FIG. **7** is an end perspective view of an assembled exterior wall of FIG. **1** constructed in accordance with a second embodiment of the invention, as viewed from an interior side thereof, with foam bodies of select insulation panels thereof omitted for illustrative purpose.

[0025] FIG. **8** is another perspective view of the assembled wall of FIG. **7** from the interior side thereof, and illustrating installation of electrical utility components therein.

[0026] FIG. **9** is another perspective view of the assembled wall of FIG. **8** from the interior side thereof with

select components thereof partially cut away, and illustrating installation of interior drywall thereon.

[0027] FIG. **10** is a top perspective view illustrating attachment of the assembled wall of FIG. **8** to a neighbouring perpendicular wall of the same structure at an exterior corner of a building construction.

[0028] FIG. **11** is another perspective view of the assembled wall of FIG. **7** from the interior side thereof prior to the installation of the electrical wiring and drywall of FIGS. **8** and **9**, and illustrating optional framing of a window opening in the wall.

[0029] FIG. **12** is a perspective view of an alternative embodiment in which air filled void spaces in an intermediate layer of the exterior wall construction between insulation panels of interior and exterior layers of the wall construction are instead replaced with an additional layer of insulation panels, optionally being smaller panels framed by spacer boards that framed the air filled void spaces in the embodiments of the preceding figures.

DETAILED DESCRIPTION

[0030] FIGS. **1** to **6** of the drawings illustrate a first embodiment of a novel exterior wall assembly **2** of the present invention, which employs a three-layer construction composed of an interior insulation layer **4** composed of rigid insulation panels, an opposing exterior insulation layer **6** also composed of rigid insulation panels, and an intermediate spacing layer **8** composed of a plurality of spacer boards sandwiched between the insulation panels of the two insulation layers **4**, **6** and delimiting a plurality of air-filled, but otherwise unoccupied, void spaces **10** therebetween. The insulation panels of the interior insulation layer **4** are referred to herein as interior insulation panels **12**A, **12**B, and the insulation panels of the exterior insulation layer **6** are likewise referred to herein as exterior insulation panels **12**C. When the expression "insulation panel" is used herein in generic fashion, unaccompanied by an "interior" or "exterior" qualifier, reference is being made to features that are common to both the interior and exterior insulation panels **12**A-**12**C.

[0031] Each insulation panel **12**A-**12**C is composed of the same general subcomponents, namely a foam core **22** of expanded polystyrene (EPS) or other foam material that is known to be suitable for rigid insulation panels, and two heat-reflective facers respectively applied to the foam core **22** at two opposing faces of the insulation panel. In the assembled and erected state of the wall, each face of each insulation panel **12**A-**12**C faces either toward the interior space of the building, or away from the interior space of the building and toward the external environment outside the building. The heat-reflective facer on each face of each insulation panel **12**A, **12**B reflects radiant heat energy, thereby reducing heat transfer through the foam cores of the insulation panels **12**A-**12**C to minimize heat transfer between the building's interior space and the external environment. Preferably, each laminated facer comprises a metalized polymer film laminated onto the foam core **22**. The two faces of each insulation panel **12**A-**12**C are rectangular in shape, and so the exterior of the foam core is composed of these two rectangular faces, plus four perimeter edges that span around the outer perimeters of the two rectangular faces. Each facer may be a uniformly intact and continuous span of material over the surface area of the respective face of the insulation panel, or may be a perforated sheet of the material having small pore-like holes or openings therein to increase the vapour permeability of the facer, as disclosed in Applicants issued U.S. Pat. No. 11,028,578, the entirety of which is incorporated herein by reference.

[0032] A length of each insulation panel, measured in one direction across each of its faces in any reference plane parallel to those faces, exceeds a width of the panel that is measured orthogonally of the length in the same plane. A thickness of each insulation panel between its two faces, as measured orthogonally of both the length and width thereof, is the smallest of the panel's three orthogonal dimensions. The four perimeter edges of each insulation panel include two lengthwise edges (one of which is labeled **30**) of greater span than the two widthwise edges. Except where otherwise described, one lengthwise edge of each insulation panel features a male tongue **34** jutting outward therefrom over the full length of the panel from one widthwise edge **32** to the other. The other lengthwise edge **30** of each insulation panel features a female groove **36** recessed thereinto over the full length of the panel, whereby the tongue of one insulation panel is insertable into the groove of the next insulation panel to mate the insulation panels together via a tongue and groove interface at adjacent lengthwise edges of the two insulation panels. The exterior insulation panels **12**C are oriented lengthwise-up in the assembled and erected state of the wall, whereby their lengthwise edges **30** stand vertically upright, while the interior insulation panels **12**A-**12**B are installed widthwise-up, whereby their widthwise edges **32** stand vertically upright and their lengthwise edges run horizontally of the assembled and erected wall.

[0033] At discretely spaced intervals across the width dimension W of each insulation panel **12**A-**12**C, a plurality of elongated rectangular battens are recessed into one of the two opposing faces of the panel's foam core. Each batten runs the full length of the insulation panel in perpendicular relation to the width thereof, thus spanning fully from one widthwise edge **32** of the insulation panel to the other. At least a subset of the battens of each insulation panel **12**A-**12**C are embedded battens that are overlaid by the respective laminated facer and are evenly spaced from one another across the width of the insulation panel. In the illustrated embodiments, all of the battens of each exterior insulation panel **12**C are embedded battens **37**A covered by one of the panel's laminated facers, while all but one of the battens of each interior insulation panel **12**A are embedded battens **37**B covered by one of the panel's laminated facers.

[0034] In the illustrated embodiments, the length of each insulation panel is twice the width thereof, for example with each insulation panel measuring 4-feet wide and 8-feet long, and each insulation panel has three embedded battens space apart at 16-inch center-to-center intervals, with the outer two of the three embedded battens each being spaced 8-inches from the nearest lengthwise edge of the insulation panel to maintain the 16-inch batten spacing interval from one insulation panel to the next. The exterior insulation layer **6** is composed of a single row of exterior insulation panels **12**C mated together side-by-side at their tongue-and-grooved lengthwise edges, while the interior insulation layer is composed of two rows of interior insulation panels, of which an upper row of interior insulation panels **12**A resides atop a lower row of interior insulation panels **12**B. In each row, the interior insulation panels **12**A, **12**B are abutted together at their widthwise edges **32**. The lengthwise edges of the lower row of interior insulation panels mate via tongue and

groove interface with the lengthwise edges of the upper row. In the illustrated embodiments, the interior insulation panels **12**A, **12**B are oriented groove-up/tongue-down, whereby the lengthwise tongues **34** of the upper row of interior insulation panels mate with the lengthwise grooves **36** of the lower row of interior insulation panels.

[0035] In this example where the interior insulation panels **12**A, **12**B are installed in a groove-up orientation, the tongues **34** of the bottom row of interior insulation panels are either cut off, or pre-emptively omitted in entirety during fabrication, so that the bottom lengthwise edges of the bottom row of interior insulation panels **12**B can be seated flat against an underlying support surface (floor **38**) atop which the assembled/erected wall stands in its finished state. Alternatively, the interior insulation panels **12**A, **12**B may be installed in tongue-up orientation, whereby the grooved bottom lengthwise edge of the bottom row of interior insulation panels can rest flat against the underlying support surface, and in which case the tongues of the upper row of interior insulation panels **12**A may be either cut off, or pre-emptively omitted in entirety during fabrication, so that the top lengthwise perimeter edges of the top row of interior insulation panels are rendered tongueless. This way, the absence of a protruding tongue prevents interference with mounting of roof componentry atop the assembled and erected wall **2**.

[0036] As shown in the example of the single-row exterior insulation layer **6** and double-row interior insulation layer **4** that are assembled from insulation panels of matching elongated size whose length is twice its length, the top widthwise edges **32** of the exterior insulation panels **12**C reside flush with the top lengthwise edges **30** of the top row of interior insulation panels **12**A, and thus lie in coplanar relation therewith at the top of the assembled and erected wall **2**. Likewise, the bottom widthwise edges of the exterior insulation panels **12**C reside flush with the bottom lengthwise edges of the bottom row of interior insulation panels **12**B in coplanar relationship therewith to rest atop the underlying support surface **38** at the bottom of the assembled and erected wall **2**. It will be appreciated that a wall whose targeted height is not evenly divisible by the insulation panel height and width may nonetheless be constructed, for example by trimming down prefabricated insulation panels of a standardized size to fulfill the targeted wall height. Likewise interior and exterior insulation panels at one or both ends of each row thereof can be trimmed down to meet a targeted overall width of the wall.

[0037] As mentioned earlier, all but one of the battens in each interior insulation panel **12**A, **12**B are embedded battens, referred to as such due their encapsulated state beneath the laminated facer that overlies the respective face of the foam core into which the battens are recessed. The face at which the embedded battens **37**B are embedded in each interior insulation panel **12**A, **12**B is referred to herein an interior face thereof, because once the wall **2** is assembled and erected, this interior face of each interior insulation panel **12**A, **12**B faces inwardly toward the interior space of the building being constructed. In the drawings, the interior space of the building is recognizably denoted by included illustration of a horizontal floor **38** of the building's interior, at whose perimeter the assembled and erected wall **2** stands upright. The opposing face of each interior insulation panel **12**A, **12**B that faces outwardly away from the interior space of the building, and toward the external environment outside the building, is referred to herein as an outer face of the interior insulation panel **12**A, **12**B. To differentiate it from the embedded battens **37**B, the singular remaining batten of each interior insulation panel that is not encapsulated under the laminated facer of the panel's interior face (the "interior facer", for short), is instead referred to herein as an exposed batten.

[0038] In the top row of interior insulation panels **12**A, the exposed batten **37**C is an uppermost one of the panel's battens, and is recessed into the foam core at the top lengthwise edge **30** of the panel. This exposed uppermost batten **37**C may be installed on the top row interior insulation panel **12**A on-site during the assembly of the wall, in which case this exposed uppermost batten **37**C is only secured to the foam core **22** of the interior insulation panel **12**A during fastening of the interior insulation panel **12**A to other wall components during the assembly process, which is described further below. In such instances where the exposed uppermost battens **37**C are installed on-site during the wall assembly process, a plurality of batten boards installed end-to-end with one another to span the overall top row of interior insulation panels **12**A and collectively form the exposed uppermost battens **37**C thereof need not necessarily be installed in a one-to-one ratio with the quantity of panels **12**A in that row, need not necessarily have individual lengths equal to those of the interior insulation panels, and thus need not each be aligned with a respective interior insulation panel **12**A to span the particular individual length thereof.

[0039] In the bottom row of interior insulation panels **12**B, each panel's exposed batten **37**D is instead a lowermost one of the panel's battens, and is recessed into the foam core at the bottom lengthwise edge of the panel. The exposed lowermost battens **37**D may be installed on the bottom row of interior insulation panels **12**B on-site during the assembly of the wall **2**, in which case this exposed lowermost batten **37**D is only secured to the foam core **22** of the interior insulation panel **12**B during fastening of the interior insulation panel **12**B to other wall components during the wall assembly process, which is described further below. In such instance of on-site installation of the lowermost batten **37**D, and just as described for the exposed uppermost battens **37**C of the top row of interior insulation panels **12**A, a plurality of batten boards installed end-to-end with one another to span the overall bottom row of interior insulation panels **12**B to collectively form the exposed lowermost battens **37**D thereof need not necessarily be installed in a one-to-one ratio with the quantity of panels **12**B in that row, need not necessarily have individual lengths equal to those of the interior insulation panels, and thus need not each be aligned with a respective interior insulation panel **12**B to span the particular individual length thereof.

[0040] In the first embodiment, where the exposed uppermost and lowermost battens **37**C, **37**D are installed on site, an uppermost strip of the interior face of each upper row interior insulation panel **12**A, and a lowermost strip of the interior face of each lower row interior insulation panel **12**B, are recessed relative to the rest of the interior insulation panel's interior face. In other embodiments, instead of providing an initially unoccupied and recessed strip at the interior face to accommodate on-site installation of an exposed batten **37**C, **37**D, the uppermost and lowermost battens **37**C, **37**D of the top and bottom row interior insu-

lation panels **12**A, **12**B may be preinstalled at the time of factory production, and may optionally be overlaid by the laminated interior facer.

[0041] Turning attention to the exterior insulation panels **12**C, the face of each exterior insulation panel **12**C that faces toward the interior insulation panels **12**A, **12**B, and thus also faces toward the interior space of the building, is referred to as an inner face of the exterior insulation panel **12**C. The opposing face of each exterior insulation panel **12**C thus faces away from both the interior insulation panels **12**A, **12**B and the building's interior space, and faces toward the external environment, and is therefore referred to as the exterior face of the exterior insulation panel. The embedded battens **37**A of the exterior insulation panels **12**C are recessed into the foam cores **22** of the exterior insulation panels **12**C at the exterior faces thereof, and are thus covered by the exterior laminated facers that overlie the foam cores of the exterior insulation panels at the exterior faces thereof.

[0042] All of the facers of both the interior and exterior insulation panels, or if not all of the facers, at least the interior and outer facers of the interior insulation panels **12**A, **12**B and the exterior facers of the interior insulation panels **12**C, have printed indicia thereon marking the positions of the embedded battens **37**A, **37**B concealed beneath the facer, which enables visual identification of suitable fastening locations at which to fasten together the wall components during assembly of the wall **2**, as described further below.

[0043] From the foregoing descriptions of the interior and exterior insulation panels, it will be appreciated that they are of notably similar composition and shape to one another, with the only difference being the incorporation of the additional (and optionally exposed) battens **37**C, **37**D on the interior insulation panels **12**A, **12**B, whether during factory production thereof or later on during on-site assembly. Accordingly, a manufacturer can optionally produce a volume of identical insulation panels according to the specifications of the described exterior insulation panels **12**C, from which a subset of those identical insulation panels are then subjected to additional processing to cut away an uppermost or lowermost strip from the batten-equipped face each panel in the selected subset to thereby form an upper-row interior insulation panel **12**A or lower-row interior insulation panel **12**B for the interior insulation layer **4** of the assembled wall **2**.

[0044] Having described the interior and exterior insulation panels used in the insulation layers of the wall, attention is now turned to the remaining intermediate layer that resides between the two insulation layers. The intermediate layer features a set of spacer boards, each of which may have width and thickness equal to those of the embedded battens **37**A, **37**B of the interior and exterior insulation panels **12**A-**12**C, whose width and thickness in turn may also be equal to those of the exposed battens **37**C, **37**D. This way, the batten boards used for the embedded battens **37**A, **37**B and the exposed battens **37**C, **37**D share common dimensions with the spacer boards, thus enabling manufacturing efficiencies, where these different boards can be cut to size using the same cutting operations. In the illustrated embodiments, the batten boards and spacer boards of are plywood boards, though other board compositions, wooden or otherwise, may alternatively be used, provided they have sufficient strength and rigidity, which should exceed those of the foam cores of the insulation panels, as it is the batten and spacer boards that are used to fasten together the different layers of the wall and cooperatively impart sufficient structural integrity to the assembled and erected wall. In one non-limiting example, the batten and spacer boards measure 3-inches wide, and 0.75-inches thick.

[0045] The spacer boards are sandwiched between the outer face of the interior insulation panels **12**A, **12**B and the inner face of the exterior insulation panels **12**C, and include upright spacer boards **40** that lie vertically in the assembled and erected state of the wall **2**, and lateral spacer boards **42**, **44** that lie horizontally in the assemble and erected state of the wall. The upright spacer boards **40** are installed at regularly spaced intervals across the width of the wall. The lateral spacer boards include header boards **42** that run along the top perimeter edges of the interior and exterior insulation panels **12**A-**12**C at the top ends of the upright spacer boards **40**, and footer boards **44** that run along the bottom perimeter edges of the interior and exterior insulation panels **12**A-**12**C at the bottom ends of the upright spacer boards **40**. In the illustrated example, the header boards **42** are abutted end-to-end to provide a continuous header spanning across the full width of the wall in uninterrupted fashion, and the footer boards **44** are likewise abutted end-to-end to provide a continuous footer spanning across the full width of the wall in uninterrupted fashion. The upright boards each fully span the distance between the header and footer, with a top end of each upright spacer board **40** terminating in in abutted relation against the bottom edge of the header, and a bottom end of each upright board terminating in abutted relation against a top edge of the footer.

[0046] The spacer boards **40**-**44** are fastened to the battens **37**B-**37**D of the interior insulation panels **12**A, **12**B via a first set of fasteners **46** (e.g. framing nails) that penetrate through the spacer boards **40**-**44** from the exterior sides thereof that face the external environment, and onward through the foam cores **22** of the interior insulation panels **12**A, **12**B into the battens **37**B-**37**D at the interior face thereof, but without penetrating through the interior face. This first set of fasteners **46** serves to secure the spacer boards to the interior insulation panels **12**A, and thus is referred to herein as a set of interior fasteners **46**. The interior fasteners **46** are used to fasten each header board **42** to the uppermost battens **37**C of the top row of interior insulation panels **12**A, to likewise fasten each footer board **44** to the lowermost battens **37**D of the bottom row of interior insulation panels **12**B, and to fasten each upright spacer board **40** to the remaining other battens **37**B that reside between the uppermost and lowermost battens **37**C, **37**D.

[0047] The exterior insulation panels **12**C are secured to the spacer boards **40**-**44** by a second set of fasteners **48**, which is thus referred to herein as a set of exterior fasteners **48**. The exterior fasteners **48** penetrate through the battens **37**A of the exterior insulation panels **12**C from the exterior faces thereof, and onward through the foam cores **22** of the exterior insulation panels **12**C into the header and footer boards **42**, **44** (and optionally into any intermediate lateral spacer boards, if included). The exterior fasteners **48** may penetrate fully through the header and footer boards **42**, **44** for optimal fastening strength thereto, but are short enough so as to not fully penetrate the foam cores **22** of the interior insulation panels **12**A, **12**B, and to stop short of the uppermost and lowermost battens **37**C, **27**D of the interior insulation panels **12**A, **12**B to avoid thermal bridging across the

assembled wall thickness. The exterior fasteners **48** are used to fasten the battens **37**A of the exterior insulation panels **12**C to the header and footer boards **42**, **44** of the intermediate layer **8**. The interior and exterior insulation layers **4**, **6** are thereby indirectly fastened together via the fastening of their respective battens to the spacer boards **40**-**44** of the intermediate layer **8**.

[0048] The spacer boards **40**-**44** set the interior and exterior insulation panels apart from one another by a gap distance equal to the thickness of the spacer boards. The thickness of each spacer board is the shortest of its three orthogonal dimensions, of which its length is the greatest. The two broad faces of each spacer board, whose surfaces areas are the product of the board's length and width, lie parallel to the faces of the insulation panels **12**A-**12**C, and thus face inwardly toward the building's interior space and outwardly away therefrom toward the external environment. This is of contrary relation to the stud orientation in a conventionally framed wall, where the narrower edges (not the broader faces) of the wall studs face the building interior and external environment. With the flat outer faces of the interior insulation panels **12**A, **12**B being spaced apart from the flat inner faces of the exterior insulation panels **12**C by the thickness of the spacer boards **40**-**42**, a plurality of air-filled but otherwise unoccupied void spaces **10** are delimited between the interior and exterior insulation panels. Each such void space **10** is bound on two sides by an adjacent pair of the upright spacer boards **40**, and bound at the top and bottom by the header and footer boards **42**, **44** that span between the adjacent pair upright spacer boards **40**.

[0049] Unlike the stud cavities of a conventionally framed exterior wall, which are typically filled with batt insulation, these void spaces **10** in the inventive wall **2** are left empty of any insulation material or other non-gaseous substance, and therefore contain only air, and thus serve as heat-insulative air cavities. In the illustrated embodiments, where the outer faces of the interior insulation panels **12**A, **12**B and the inner faces of exterior insulation panels **12**C are each laminated with a heat-reflective facer, the thermally insulative performance of these void spaces **10** between the two insulation layers **4**, **6** is believed to be particularly effective. With two insulation layers **4**, **6**, unoccupied void spaces **10** delimited therebetween in an intermediate layer **8**, and heat-reflective facers that not only reflect thermal energy but also mitigate vapour permeation through the insulation layers, a thermally effective and moisture mitigating wall structure **2** is achieved. The wall **2** is easy to assemble using only prefabricated insulation panels **12**A-**12**C and relatively thin boards that can be easily and efficiently transported as a flat-pack kit, without the need for the vapour barrier sheeting or batt insulation of conventionally framed wall constructions. The battens **37**A of the exterior insulation panels **12**A enable subsequent fastening of any variety of external cladding to the assembled and erected wall **2** at the building exterior, just as the battens **37**B-**37**D of the interior insulation panels **12**A, **12**B enable subsequent fastening of interior wall finishes (drywall, paneling) within the building interior, along with fastening of such finishing trim as baseboards, moulding, etc. to the uppermost and lowermost battens **37**C, **37**D of the interior insulation panels **12**A, **12**B.

[0050] Having described the finished structure of the assembled and erected wall **2**, attention is now turned to a preferred process for assembling the wall components. Firstly, the two rows of interior insulation panels **12**A, **12**B are laid out edge-to-edge with one another atop the floor **38** or other horizontal support surface, with the interior faces of these panels **12**A, **12**B facing downward, and with the tongues and grooves of the two rows of panels **12**A, **12**B mated together, and preferably secured in such mated condition with tape, spray foam, adhesive or other suitable securement agent. If the uppermost and lowermost **37**C, **37**D battens of the interior insulation panels **12**A, **12**B have not been pre-installed, they are now placed beneath the laid-out top and bottom rows of interior insulation panels **12**A, **12**B in the recessed strips at the top and bottom edges thereof, respectively. Next, the spacer boards **40**-**44** are laid atop the already laid-out interior insulation panels **12**A, **12**B, with the header boards **42** running along the top edges of the top row of insulation panels **12**A, the footer boards **44** running along the bottom edges of the bottom row of insulation panels **12**B, and the upright spacer boards **40** spanning perpendicularly between the header boards **42** and footer boards **44**. The laid-out spacer boards **40**-**44** are then fastened in place by driving the interior fasteners **46** downwardly through the spacer boards **40**-**44** and into the battens **37**B-**37**D of the underlying interior insulation panels **12**A, **12**B, without penetrating fully therethrough into the floor **38**, owing to the appropriately selected length of interior fastener **46**.

[0051] Next, the exterior insulation panels **12**C are laid out side-by-side in a singular row atop the spacer boards **40**-**44** and the underlying interior insulation panels **12**A, **12**B to which the spacer boards have been fastened. The exterior insulation panels **12**C are laid out with their exterior faces facing upwardly, with their battens **37**A lying perpendicularly to the battens **37**B-**37**D of the interior insulation panels **12**A, **12**B, and with their tongues and grooves **34**, **36** mated together at their abutting lengthwise edges. The laid-out exterior insulation panels **12**C are then fastened in place by driving the exterior fasteners **48** downwardly through the battens **37**A of the exterior insulation panels **12**C and into the lateral spacer boards **42**, **44** already fastened atop the underlying interior insulation panels **12**A, **12**B, once again without penetrating fully through the foam cores **22** thereof, owing to the appropriately selected length of exterior fastener **48**.

[0052] Having fastened the spacer boards **40**-**44** to the interior insulation panels **12**A, **12**B, then fastened the exterior insulation panels **12**C to a subset of the spacer boards, the interior and exterior insulation panels **12**A-**12**C and spacer boards **40**-**44** are now all secured together into an assembled unit, which can then be erected into an upright position standing atop the floor **38**. The assembled unit **10** is then appropriately positioned at a perimeter boundary of the floor **38**, such that the interior faces of the interior insulation panels **12**A, **12**B face horizontally inward over the floor **38** of the building interior, and the exterior faces of the exterior insulation panels **12**C face horizontally outward from the interior floor **38** toward the external environment. After having stood the assembled unit upright, additional interior and/or exterior fasteners **46**, **48** can be added to further increase the structural rigidity of the assembled and erected wall **2**.

[0053] FIGS. **7** to **11** illustrate a second embodiment of the novel exterior wall assembly **2'**, which again features interior and exterior insulation layers **4'**, **6** both composed of insulation panels of same type described above for the first embodiment, and an intermediate spacing layer **8'** once again composed of spacer boards sandwiched between the

two insulation layers **4'**, **6** to once again bound air-filled voids therebetween in similar manner to those of the first embodiment. To these three layers, the second embodiment wall adds an interior spacing layer **50** likewise composed of spacer boards fastened to the embedded battens of the interior insulation layer **4'**, but installed at the interior face thereof rather than the outer face thereof. In this embodiment, the interior spacing layer **50** enables mounting of the drywall or other interior finishing material over the interior face of the wall at a short distance offset inwardly therefrom by the spacer boards of the interior spacing layer **50**, thereby creating additional air-filled voids between the drywall and the interior insulation panels. These additional voids on the interior side of the interior insulation panels can be used to accommodate installation of electrical or other utilities, while also creating a second array of heat-insulative air cavities at the interior faces of the interior insulation panels to supplement the first array of heat-insulative air cavities at the outer faces thereof, thus increasing the overall insulative value of the finished wall assembly.

[0054] Before turning to the details of the added interior spacing layer **50**, the second embodiment is first used to a describe a few details among the insulation layers and intermediate spacing layer **8'** thereof that offer alternatives to those described above for the first embodiment. Unlike the first embodiment, where the internal insulation panels **12**A, **12**B were laid out widthwise-up in perpendicular relation to the lengthwise-up orientation of the exterior insulation panels **12**C, with the result that the embedded battens **37**A, **37**B of the two insulation layers are of orthogonal relationship to one another, the second embodiment instead has the internal and external insulation panels placed in the same lengthwise-up orientation as one another, whereby the embedded battens **37**A, **37**B of the two insulation layers are laid out parallel to one another, and optionally in alignment with one another. In the second embodiment, all of the interior insulation panels are therefore labelled simply as **12**A, given that there is only a singular row of such panels in this embodiment, without the accompanying second row **12**B that was included in the multi-rowed instance of the first embodiment.

[0055] Another difference in the second embodiment is the inclusion of a greater quantity of lateral spacer boards in the intermediate spacing layer **8'**, where in addition to the header boards **42** running along the top perimeter edges of the interior and exterior insulation panels **12**A, **12**B and the footer boards **44** running along the bottom perimeter edges of the interior and exterior insulation panels **12**A, **12**C, there are a plurality of intermediate lateral spacer boards **45** distributed in parallel relation to, and at regularly spaced intervals between, the header and footer boards **42**, **44**. In accompaniment to this change, at least at each end of the assembled wall, a set of upright spacer boards **40'** of individually shorter length than the longer upright spacer boards **40** of the first embodiment are included. Each such upright spacer board **40'** spans the vertical distance between a respective neighbouring pair of the lateral spacer boards **42**, **44**, **45**, instead of spanning the longer full distance between the header and footer boards **42**, **44** like the longer upright spacer boards **40** of the first embodiment. So, in the first embodiment, each void space **10** in the intermediate spacing layer **8** was a rather tall cavity spanning the entire vertical distance between the header and footer boards **42**, **44**, and spanning the horizontal distance between two full-length upright-spacer boards **40**. In the second embodiment, each void space **10**A in the intermediate spacing layer **8** is a horizontally elongated and vertically narrower cavity spanning the vertical distance between an adjacent pair of the larger quantity of lateral spacer boards **42**, **44**, **45**, and the horizontal distance from one set of upright spacer boards **40'** to another, for example from one end of the wall to the other. That said, additional sets of upright spacer boards **40'** may optionally be installed at periodic intervals along the overall wall width, like the taller upright spacer boards **40** of the first embodiment.

[0056] Turning now to the second embodiment's interior spacing layer **50**, it is of the same construction of the second embodiment's intermediate spacing layer **8** described in the preceding paragraph, thus having header boards **52** running along the top perimeter edges of the interior insulation panels **12**A; footer boards **54** running along the bottom perimeter edges of the interior insulation panels **12**A; a plurality of intermediate lateral spacer boards **55** distributed in parallel relation to, and at regularly spaced intervals between, the header and footer boards **52**, **54**; and, at least at each end of the wall **2'**, a set of upright spacer boards **60** each spanning the vertical distance between a respective neighbouring pair of the lateral spacer boards **52**, **54**, **55**. Since the embedded battens **37**B of the interior insulation panels **12**A of the second embodiment are vertically oriented, not horizontally oriented like those of the first embodiment, the header and footer boards **52**, **54** of the interior spacer layer **50** effectively replace the exposed uppermost and lowermost battens **37**C, **37**D when it comes to fastening of finishing trim (baseboards, moulding) to the drywalled or otherwise finished wall interior at the end of the installation process.

[0057] Like in the first embodiment, a set of interior fasteners **46** (see FIG. **10**) for fastening the intermediate layer's spacer boards **40'**, **42**, **44**, **45** to the interior insulation panels penetrate through the spacer boards **40'**, **42**, **44**, **45** from the exterior sides thereof that face the external environment, and onward through the foam cores **22** of the interior insulation panels **12**A into the battens **37**B at the interior face thereof, but without penetrating through the interior face. Since these fasteners **46** must be shallow enough to only partially penetrate the embedded battens **37**B, further securement of the intermediate layer's spacer boards **40'**, **42**, **44**, **45** may be provided by a supplemental second set of interior fasteners **46'** (e.g. framing nails) that are be driven through the embedded battens **37**B of the interior insulation panels **12**A from the interior faces thereof (i.e. in the opposite direction from the first set of interior fasteners **46**), and onward through the foam cores **22** of the interior insulation panels **12**A into or through the lateral spacer boards **42**, **44**, **45** of the intermediate spacing layer **8'** (and optionally also into or through the upright spacer boards **40'** thereof anywhere a subset of the embedded battens **37**B align therewith), but without penetrating fully through the foam cores **22** of the exterior insulation panels **12**C nor into the embedded battens **37**A thereof, thereby avoiding thermal bridging across the full assembled wall thickness.

[0058] The second embodiment includes yet another set of fasteners **46**A (e.g. framing nails) driven through the embedded battens **37**B of the interior insulation panels **12**A, this time for the purpose of holding the spacer boards of the interior spacing layer **50**. At least a subset of these interior

spacer fasteners **46**A are driven through the lateral spacer boards **52**, **54**, **55** of the interior spacing layer **50** from an interior side thereof, onward through the embedded battens **37**B of the interior insulation panels **12**A, and further onward through the foam cores **22** thereof into or through the lateral spacer boards **42**, **44**, **45** of the intermediate spacing layer **8'**, which reside in alignment with the lateral spacer boards **52**, **54**, **55** of the interior spacing layer **50**, but without penetrating fully through the foam cores **22** of the exterior insulation panels **12**C, nor into the embedded battens **37**A thereof, thereby again avoiding thermal bridging across the full wall thickness. Another subset of these interior spacer fasteners **46**A may penetrate the lateral spacer boards **52**, **54**, **55** of the interior spacing layer **50** into the lateral spacer boards **42**, **44**, **45** of the intermediate spacing layer **8'** at locations between, and thus not penetrating, the embedded battens **37**B of the interior insulation panels **12**C. Another subset of the interior spacer fasteners **46**A may be driven through the upright spacer boards **60** of the interior spacing layer **50** from the interior side thereof, onward through the embedded battens **37**B of the interior insulation panels **12**A, and further onward through the foam cores **22** thereof into or through the upright spacer boards **40'** of the intermediate spacing layer **8'**, which reside in alignment with the upright spacer boards **60** of the interior spacing layer **50** at the ends of the wall, again without penetrating fully through the foam cores **22** of the exterior insulation panels **12**C, nor into the embedded battens **37**A thereof, to avoid thermal bridging across the full wall thickness.

[0059] The exterior fasteners **48** in the second embodiment are driven in matching fashion to the first embodiment, i.e. through the embedded battens **37**A of the exterior insulation panels **12**C from the exterior faces thereof, onward through the foams cores **22** of the exterior insulation panels **12**C, and into or through the lateral spacer boards **42**, **44**, **45** of the intermediate spacing layer **8'** (and optionally also into or through the upright spacer boards **40'** thereof anywhere a subset of the embedded battens **37**A align therewith), but without penetrating fully through the foam cores **22** of the interior insulation panels **12**A, nor into the embedded battens **37**B thereof, again to avoid thermal bridging across the full wall thickness.

[0060] FIG. **10** illustrates joining of two neighbouring walls of the second embodiment where they meet together in perpendicular relationship to one another at an exterior corner of a building. At the end of one these walls, the last embedded batten of the respective exterior insulation panel **12**C has been removed, and in its place has been substituted a wider fastening batten **62** of greater width than, but equal thickness to, the formerly embedded batten, now removed. The width of this fastening batten **62** reaches beyond the upstanding lengthwise end of the respective exterior insulation panel **12**C, by a projecting distance approximately equal to the thickness of the neighbouring wall, whose upstanding end is abutted up against the projecting portion of the fastening batten **62**. To the exterior insulation panel **12**C whose removed batten was replaced with the fastening batten **62**, the fastening batten **62** is fastened by a subset of that wall's exterior fasteners **48**, driven straight through the fastening batten **62** from the exterior side thereof into the spacer boards **42**, **44**, **45**, **60** of the intermediate spacing layer **8'** of that same wall. As also shown in FIG. **10**, a first set of angled exterior corner fasteners **64**A (e.g. framing nails), at spaced elevations along the fastening batten **62**, may also be driven through the fastening batten **62** from the exterior side thereof and into or through the nearest embedded batten **37**B of the interior insulation layer **4'** of the neighbouring wall. For brevity, the embedded battens **37**B of the interior insulation layer of either wall may be referred to as the interior battens thereof, just as the embedded battens of the exterior insulation layer of either wall may be referred to as the exterior battens thereof. As also shown, a second set of angled exterior corner fasteners **64**B (e.g. framing nails), again at spaced elevations along the fastening batten **62**, may also be driven through the fastening batten **62** from the exterior side thereof and into or through the upright and/or lateral spacer boards **40**, **42**, **44**, **45** of the intermediate spacing layer **8'** of the neighbouring wall.

[0061] Aside from such angled exterior corner fasteners **64**A, **64**B, the fastening batten **62** may be fastened straight on, again at spaced elevations therealong, to the nearest interior batten **37**B of the neighbouring wall by a first set of smaller non-angled exterior corner fasteners **66**A driven straight into that nearest interior batten **37**B at the upright narrow edge thereof abutted by the inner side of the fastening batten **62**. Likewise, the fastening batten **62** may be fastened straight on, again at spaced elevations therealong, to the nearest exterior batten **37**A of the neighbouring wall by a second set of such non-angled exterior corner fasteners **66**B driven straight into that nearest exterior batten at the upright narrow edge thereof abutted by the inner side of the fastening batten **62**. Any subset of these four contemplated exterior fasteners **64**A, **64**B, **66**A, **66**B that are of collectively capable of sufficient structural strength may be employed in the alternative to the illustrated combination of all four types.

[0062] Turning away from the exteriorly located fastening batten **62**, but still referring to FIG. **10**, further securement of the two neighbouring wall assemblies to one another is achieved at the interior side of their corner intersection by a set of angled interior corner fasteners (e.g. framing nails) **68** driven through the interior batten **37**B that resides across from the exterior fastening batten **62** on the same wall assembly thereas, and into the nearest interior batten **37**B of the other wall (i.e. the same interior batten **37**B to which the exterior fastening batten **62** is fastened by angled exterior corner fasteners **64**A).

[0063] As shown in FIG. **9**, drywall sheets **70** or other interior finishing panels are fastened to the lateral spacer boards **52**, **54**, **55** (and optionally also to the upright spacer boards **60**) of the interior spacing layer **50** of the assembled and erected wall **2'** using suitable fasteners **72** (e.g. drywall screws), which may be referred to herein as finishing fasteners to distinguish them from the interior and exterior fasteners **46**, **46'**, **46**A, **48**, **64**A, **64**B, **66**A, **66**B (e.g. nails, typically) used in the earlier wall assembly stages. Fastening of the drywall **70** indirectly to the interior insulation panels **12**A via the spacer boards **52**, **54**, **55**, **60** of the interior spacing layer **50** results in a horizontal offsetting of the drywall **70** a short distance from the interior faces of the interior insulation panels **12**A to create insulative air-filled voids therebetween, just in the same way that the spacer boards **40**, **42**, **44**, **45** of the intermediate spacing layer **8'** horizontally offset the two insulation layers from one another to also create such insulative air-filled voids therebetween. Whereas the finished wall of the first embodiment has only a singular array of such insulative air-filled voids, specifically located between the two insulation layers **4**, **6**

and bound by the spacer boards **40**, **42**, **44** of the intermediate spacing layer **8**, the second embodiment has two arrays of insulative air-filled voids: a first array of insulative air-filled voids **10**A located between the two insulation layers **4'**, **6** and bound by the spacer boards **40'**, **42**, **44**, **45** of the intermediate spacing layer **8'**, and a second array of insulative air-filled voids **10**B located between the interior insulation layer **4'** and the installed finishing layer (e.g. drywall **70**) and bound by the spacer boards **52**, **54**, **55**, **60** of the interior spacing layer **50**.

[0064] Still referring to FIG. **9**, a bead of spray foam **76** or other suitable air-tight sealant is preferably run along the inside of edge of any and all spacer boards **40**, **42**, **44** of the intermediate spacing layer **8'** that reside at outer perimeter edges of the wall assembly, thus ensuring that the first array of insulative air-filled voids **10**A are sealed in air-tight fashion from the external environment. One such bead of spray foam **76** is shown running along the bottom edge of the header board **42** of the FIG. **9** wall **2'**, and such beads may are likewise along the top edge of the footer board **44**, and the inside edge of every upright spacer board **40'** at each end of the assembled wall. Air-tight isolation of the different insulative air-filled voids of the array is not essential, hence the illustrated omission of such spray foam or other sealant beads along the intermediate lateral board **45** of FIG. **9**, though inclusion of such additional sealant beads is still within the contemplated scope of the invention.

[0065] Turning back to FIG. **8**, before the installation of the drywall **70** or other finishing of FIG. **9**, electrical wiring or other in-wall utilities may optionally be installed, taking advantage of available utility routing space denoted by the air-filled but otherwise unoccupied void spaces **10**B of the interior spacing layer **50**. The figure shows a utility mounting board **78**, whose thickness is equal, or at least no greater, than that of the spacer boards **52**, **54**, **55**, **60** of the interior spacing layer **50**, having been fastened in place to the interior face of one of the interior insulation panels **12**A an aligned relation over one of the embedded battens **37**B thereof, for example at a location of abutting adjacency to a horizontal lengthwise edge of one of the intermediate lateral spacer boards **55**, for example using the same type of interior fasteners **46**A by which the spacer boards **52**, **54**, **55**, **60** are mounted to the interior insulation panels **12**A. A small mounting cavity **80** is cut into the interior face of the interior insulation panel **12**A beside this mounting block **78**, to a sufficient depth accommodating placement of a conventional electrical box **82** in a suitable mounting position that will place the open front of the electrical box generally flush with the interior surface of the drywall **70**, thus compensating for the face that a conventional electrical box will have a depth exceeding the thickness of the typical spacer board thickness.

[0066] The electrical box **82** is fastened to the upright side edge of the mounting board **78** that neighbours this mounting cavity **80**, which may then be filled with a spray foam **83** in order to fill any excess space of the cavity **80** not occupied by the mounted electrical box **78**. Routing of electrical wiring **84** to the electrical box **78** from an electrical panel, fixture or other electrical box can be accommodated by cutting of a recessed notch or break into one or more of the spacer boards **52**, **54**, **55**, **60**. As shown in the illustrated example at the higher of the two visible lateral spacer boards **55**, any such wire-accommodating notch or break cut into the spacer board **55** may optionally be covered by a metallic or otherwise puncture-proof/resistant protection plate **86** that is affixed to the gapped or notched lateral board **55** to overlie the break or notch therein and protect the electrical wiring running therethrough. The routed wiring **84** can be anchored to the wall assembly **2'** at any location overlying any one of the embedded battens **37**B of the interior insulation panels **12**A, as demonstrated by the electrical wiring staple **88** fastened to the same embedded batten **37**B as the mounting board **78** in the illustrated example. In addition or alternative to such electrical wiring, similar routing of other utilities (plumbing, television/internet/phone cables, speaker wire, etc.) within the voids **10**B of the interior spacing layer **50** is also possible within the novel wall assembly **2'** of the second embodiment.

[0067] FIG. **11** illustrates framing of a window opening **90** in the novel wall assembly **2'** of the second embodiment. The window opening **90** is cut through all four layers **4'**, **6**, **8'**, **50** of the assembled wall **2'** at the intended window location, and a respective set of upright framing boards **92** of equal thickness to the spacer boards **52**, **54**, **55**, **60** of the interior spacing layer **50** are added to this layer on each side of the window opening **90**, with each framing board **92** spanning the vertical distance between a respective adjacent pair of the lateral spacer boards **52**, **54**, **55**. In this way, the framing boards **92** are installed in the same fashion as the upright spacer boards **60** at the ends of the wall **2'**, and are fastened to the two embedded battens **37**B of the interior insulation layer **4'** nearest to the window opening **90** on opposite sides thereof. Where the framing boards **92** may differ from the upright spacer boards **60** is that they may have a greater width, to whatever degree such extra width is necessary to ensure that each framing board **92** overlaps with the nearest embedded batten **37**B on the respective side of the window opening **90**.

[0068] Beneath the window opening, additional upright spacer boards **60'** are installed between adjacent pairs of the lateral spacer boards **54**, **55** below the window opening **90** in aligned relation over any embedded battens **37**B that intersect the bottom boundary of the window opening **90**, of which there are two such intersecting interior battens **37**B in the illustrated example. Unless the bottom boundary of the window opening **90** coincides with one of the intermediate lateral spacer boards **55**, a lower lateral filler board **94** of equal thickness to the spacer and framing boards is installed along the bottom boundary of the window opening **90**, with the filler board's length spanning between the two sets of framing boards **92**, and the lower lateral filler board's vertical width spanning from the bottom boundary of the window opening **90** to the top edge of the nearest lateral spacer board **55** beneath the window opening **90**. This lower lateral filler board **94** is fastened to the embedded interior battens **37**B that intersect the bottom boundary of the window.

[0069] Likewise, an upper lateral filler board **96** of equal thickness to the spacer and framing boards is installed along the top boundary of the window opening **90**, with this filler board's vertical width spanning from the top boundary of the window opening **90** to the bottom edge of the next lateral spacer board above the window opening **90**, which in the illustrated example is the header board **52** of the interior spacing layer **50**. In the illustrated example, the top boundary of the window opening **50** coincides with the top edges of the highest one of the intermediate lateral spacer boards **55**, and the upper lateral filler board **96** extends horizontally

beyond the vertical side boundaries of the window opening **90**, and on each side of the window opening **90**, fills the space from the top edge of the highest intermediate lateral spacer board **55** to the bottom edge of the header board **52**, thus omitting the need for the smaller framing boards **92** between the header board **52** and the highest intermediate lateral spacer board **55**. In the illustrated but non-limiting example, this upper lateral filler board **96** spans the full width of the wall **2'** from one end thereof to the other, whereby the header board **52**, upper lateral filler board **96** and highest one of the intermediate lateral spacer boards **55** cooperatively form a combined header that is of greater height and robustness than the smaller header board **52** alone, and spans the entire width of the wall **2'**, and not just the isolated area thereof above the window opening **90**. This filler board **96** is fastened to all of the embedded interior battens **37**B that it crosses over, which in the illustrated example spanning the entire width of the wall, encompasses all of the wall's embedded interior battens **37**B.

[0070] The same framing of the window opening with framing boards **92**, filler boards **94**, **96** and additional upright spacers **60'** shown at the interior spacing layer **50** is also done within the intermediate spacer layer **8'**, though illustration of such framing in the intermediate layer is not separately illustrated to avoid unnecessary duplication. In some embodiments, such window framing in the intermediate layer alone may be structurally sufficient, though it is anticipated that the window framing would typically be done within both spacing layers **8'**, **50** for optimal structural integrity. While the illustrated example is a window opening **90**, it will be appreciated that a door opening can be framed in similar fashion, with a respective set of framing boards **92** on each side of the door opening and the upper filler board **96** above the door opening, but without the lower filler and upright spacer boards **94**, **60'** given the greater height of the door opening, which will span all the way down to the footer board **54**.

[0071] The assembly process for the second embodiment wall **2'** includes substantial duplication of the assembly process described above for the first embodiment, followed by installation of the interior spacer layer **50** after erection of the assembled insulation panels and intermediate layer spacer boards. So, first the interior insulation panels are laid out in mated relation to one another batten side down (i.e. interior face down), this time in a singular row, and the interior spacer boards **40'**, **42**, **44**, **45** are laid out top the upward facing outer faces of the laid-out interior insulation panels, and fastened in place with the interior fasteners **46**. Next, the exterior insulation panels **12**C are laid out batten side up (i.e. exterior face up) in mated side-by-side relation, again preferably secured together via any of the aforementioned securement agents, in a singular row atop the spacer boards **40'**, **42**, **44**, **45** and the underlying interior insulation panels **12**A to which the spacer boards **40'**, **42**, **44**, **45** have been fastened. The laid-out exterior insulation panels **12**C are then fastened in place by driving the exterior fasteners **48** downwardly through the battens **37**A of the exterior insulation panels **12**C and into the spacer boards **40'**, **42**, **44**, **45** already fastened atop the underlying interior insulation panels **12**A.

[0072] The assembled unit is then erected, whereupon the second set of interior fasteners **46'** are driven into the interior battens **37**B to strengthen the fastened interconnection between the interior battens **37**B and the spacer boards of the intermediate layer **8'**. The interior spacer boards **52**, **54**, **55**, **60** are then fastened to the interior insulation panels **12**C at the interior faces thereof using the interior spacer fasteners **46**A. Multiple walls assembled in this fashion can then be erected, and then secured together in neighbouring pairs at corners of the building being constructed using the fastening batten **62** described above. Exterior cladding can then be fastened to the embedded battens **37**A of the exterior insulation panels **12**C at the exterior faces thereof, and electrical or other utilities installed in the interior spacing layer **50**, followed by drywall or other interior finishing. For any walls with window or door openings, the described framing thereof in the intermediate spacing layer is done amid the wall assembly process, during the installation of the intermediate spacing layer atop the laid down interior insulation panels, prior to the addition of the exterior insulation panels onto to the installed spacer board. So the door/window opening can be precut into the interior insulation panel(s) (whether on-site, or beforehand) before installation of the intermediate layer spacer boards thereon, so that the laying out of such boards includes the described framing of this door/window opening, over which the exterior insulation panel(s) is/are then laid, whether with a matching precut opening therein, or without such an opening, the cutting of may instead be left for a later post-erection cutting thereof, using the existing opening in the interior insulation panel(s) and the intermediate spacing layer framing (and the interior spacing layer framing, if included, and already installed) as a cutting guide for the door/window opening in the exterior insulation panel(s).

[0073] The entire wall assembly **2'** of the second embodiment can be assembled on site with simply a standard framing nailer, the various boards (e.g. 0.75-inch plywood, many of which may be precut and supplied with the insulative panels) and commercially available spray foam, without need for any batt insulation, polymeric vapour barrier sheeting, exterior house wrap, or exterior sheathing. As with the first embodiment, exterior cladding is installed directly onto the exterior faces of the exterior insulation panels **12**C, being fastened to the embedded battens **37**A thereof over most of the wall area, and to the fastening battens **62** at any corners of the building where two neighbouring walls intersect at a right angle and are joined by such a fastening batten **62**. The addition of the second array of thermally insulative air-filled voids **10**B by the interior spacer layer **50** of the second embodiment may increase the effective R-value of the wall by about R-3, compared to the first embodiment, with the added benefit that these voids **10**B of the interior spacing layer **50** enable easily installation and routing of electrical and/or other utilities within the wall, before final installation of the drywall or other interior finishing.

[0074] In one non-limiting example, the insulation panels may be 2-inches thick, with which 0.75-inch plywood boards results in an overall assembled wall thickness of 5.5-inches (excluding exterior cladding and interior drywall). Alternatively, use of 2.5-inch thick insulation panels is believed capable of an estimated R-value of approximately R30, with a modestly increased wall thickness of 6.5-inches. Based on prototyping, construction knowledge and research, it is estimated that with just two labourers, a 40-foot wall can be assembled and erected in less than 2-hours, ready for installation of windows, doors, exterior cladding and interior drywall.

[0075] In one alternative embodiment, instead of the areas between the spacer boards being air-filled void spaces, these spaces may alternatively be filled with smaller foam insulation panels, with or without laminated facers and typically lacking embedded battens. In this instance, these smaller panels of lesser thickness and lesser voluminous measure that are dimensioned to fit between the spacer boards, as illustrated in FIG. **13**. This embodiment also illustrates optional orienting of the larger insulation panels of the interior and exterior layers in matching orientation (e.g. horizontal) to one another with their embedded battens running parallel to one another, and with at least a subset of the spacer boards (e.g. upright spacer boards **40**) running perpendicular to the embedded battens.

[0076] In a variant of the FIG. **13** embodiment, the intermediate layer may be composed of the same type of full size, embedded-batten insulation panels as the interior and exterior layers, for example with the panels of the intermediate layer being oriented perpendicularly of the other two layers, for example with the embedded battens of the intermediate layer running horizontally and the embedded battens of the interior and exterior layers running vertically. In this variant, at least some perimeter edges of the panels of the intermediate layer may be lined with wooden boards, for example two by four lumber, optionally laid laid in abuttingly adjacent and parallel pairs, for example at least at top and bottom perimeter edges of the intermediate layer's insulation panels to form effective structural headers and footers of the wall in this intermediate layer, while still lacking a fully framed stud wall, just like the other embodiments described herein that are likewise of a panel-based construction void of conventional stud framing.

[0077] Since various modifications can be made in my invention as herein above described, and many apparently widely different embodiments of same made, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

1. A wall assembly comprising:

interior and exterior insulation layers that respectively comprise interior insulation panels and exterior insulation panels, of which both said interior insulation panels and said exterior insulations each have a foam core, two opposing faces, and plurality of perimeter edges, of which the two opposing faces of each interior insulation panel comprise an interior face that faces away from the exterior insulation layer and an outer face that faces toward the exterior insulation layer, while the two opposing faces of each exterior insulation panel comprise an exterior face that faces away from the interior insulation layer and an inner face that faces toward the interior insulation layer;

laminated onto the foam core of each of the interior insulation panels and the exterior insulation panels, at least one laminated facer respectively occupying at least one of the two opposing faces thereof;

a set of interior battens recessed into the foam cores of the interior insulation panels at the interior faces thereof;

a set of exterior battens recessed into the foam cores of the exterior insulation panels at the exterior faces thereof;

an intermediate layer sandwiched between said interior and exterior layers and configured to impart additional insulative effect;

a set of interior fasteners by which the interior insulation panels are fastened to the intermediate layer through the interior battens thereof; and

a set of exterior fasteners by which the interior insulation panels are fastened to the intermediate layer through the interior battens thereof; and

2. The wall assembly of claim **1** wherein, on each of the interior insulation panels, said at least one laminated facer comprises an outer facer occupying the outer face of the interior insulation panel.

3. The wall assembly of claim **1** wherein, on each of the exterior insulation panels, said at least one laminated facer comprises an inner facer occupying the inner face of the exterior insulation panel.

4. The wall assembly of claim **1** wherein, on each of the interior insulation panels, said at least one laminated facer comprises two laminated facers, including an interior facer occupying the interior face of the interior insulation panel.

5. The wall assembly of claim **1** wherein, on each of the exterior insulation panels, said at least one laminated facer comprises two laminated facers, including an exterior facer occupying the exterior face of the interior insulation panel.

6. The wall assembly of claim **1** wherein the intermediate layer comprises spacer boards, and a thickness of each spacer board, in a direction in which said spacer boards separate the interior and exterior insulation panels from one another, is lesser than both a width and length of the spacer board.

7. The wall assembly of claim **6** wherein said thickness of each spacer board is no greater than 1-inch.

8. The wall assembly of claim **1** wherein the intermediate layer comprises wooden spacer boards.

9. The wall assembly of claim **1** wherein the intermediate layer comprises spacer boards, and the spacer boards and at least one of either the interior battens and the exterior battens are of a same composition as one another.

10. The wall assembly of claim **9** wherein the spacer boards, the interior battens and the exterior battens are all of said same composition as one another.

11. The wall assembly of claim **1** wherein the intermediate layer comprises spacer boards and at least one of either the interior battens and the exterior battens are equal to another in at least one of either width and thickness.

12. The wall assembly of claim **1** wherein the interior battens of each interior insulation panel comprise embedded interior battens overlain by one of the at least one laminated facer of said interior insulation panel.

13. The wall assembly of claim **1** wherein the exterior battens of each exterior insulation panel comprise embedded exterior battens overlain by one of the at least one laminated facers of said exterior insulation panel.

14. The wall assembly of claim **1** further comprising a set of interior spacer boards installed on the interior face of the interior insulation panels to accept indirect mounting of interior finishings onto the interior insulation panels in offset relation therefrom, while leaving air-filled void spaces bound by said additional spacer boards between the interior insulation panels and said interior finishings.

15. The wall assembly of claim **14** further comprising one or more utilities installed within the wall assembly, and comprising utility componentry occupying one or more of the additional air-filled void spaces.

16. The wall assembly of claim **15** wherein said utility componentry comprises one or more electrical boxes

installed among said one or more of the additional air-filled void spaces, and electrical wiring routed to said one or more electrical bosses through at least one of said one or more of the additional air-filled void spaces.

17. A method of assembling the wall assembly of claim **1**, said method comprising:

laying a first one of either the interior insulation panels or the exterior insulation panels down atop a support in a batten-down orientation;

laying components of the intermediate layer atop said first one of either the interior insulation panels or the exterior insulation panels, and fastening said components of the intermediate layer to the battens of said first one of either the interior insulation panels or the exterior insulation panels thereof through the foam cores thereof;

laying a second one of either the interior insulation panels or the exterior insulation panels atop the fastened components of the intermediate layer in a batten-up orientation, and fastening said second one of either the interior insulation panels or the exterior insulation panels to the fastened components of the intermediate layer through the foam cores of said second one of either the interior insulation panels or the exterior insulation panels, whereupon the interior insulation panels, the intermediate layer and the exterior insulation panels are now fastened together into an assembled unit.

18. The method of claim **17** wherein said first one of either the interior insulation panels or the exterior insulation panels is said interior insulation panels, and said second one of either the interior insulation panels or the exterior insulation panels is said exterior insulation panels.

19. A method of assembling the wall assembly of claim **1**, said method comprising:

laying the interior insulation panels down atop a support surface with the interior faces thereof facing downward;

laying components of the intermediate layer atop the laid down interior insulation panels at the outer faces thereof, and fastening said components of the intermediate layer to the interior battens of the interior insulation panels through the foam cores thereof; and

laying the exterior insulation panels down atop the fastened components of the intermediate layer, and fastening the exterior battens to the fastened components of the intermediate layer through the foam cores of the exterior insulation panels, whereupon the interior insulation panels, the intermediate layer and the exterior insulation panels now fastened together into an assembled unit.

20. The method of claim **17** further comprising erecting said assembled unit into an upright position in which the interior faces of the interior insulation panels and the exterior faces of the exterior insulation panels face in opposing horizontal directions.

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