US009670669B2

(12) **United States Patent**
Gosling et al.

(10) **Patent No.: US 9,670,669 B2**
(45) **Date of Patent: Jun. 6, 2017**

(54) **MODULAR BUILDING CONSTRUCTION SYSTEM**

(71) Applicant: **Dirtt Environmental Solutions, Ltd.**, Calgary (CA)

(72) Inventors: **Geoff Gosling**, Calgary (CA); **Mogens Smed**, DeWinton (CA)

(73) Assignee: **DIRTT Environmental Solutions, Ltd.**, Calgary (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/009,728**

(22) PCT Filed: **Jun. 6, 2013**

(86) PCT No.: **PCT/US2013/044524**
§ 371 (c)(1),
(2) Date: **Oct. 3, 2013**

(87) PCT Pub. No.: **WO2013/188211**
PCT Pub. Date: **Dec. 19, 2013**

(65) **Prior Publication Data**

US 2015/0300008 A1 Oct. 22, 2015

Related U.S. Application Data

(60) Provisional application No. 61/658,403, filed on Jun. 11, 2012.

(51) **Int. Cl.**
E04B 2/72 (2006.01)
E04B 1/14 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***E04B 2/721*** (2013.01); ***E04B 1/14*** (2013.01); ***E04B 1/40*** (2013.01); ***E04B 1/6125*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC E04B 2/721; E04B 1/40; E04B 2002/7462; E04B 1/14; E04B 1/6125; E04B 1/6145;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,757,116 A * 7/1956 Clements E04C 2/292 156/182
3,037,590 A * 6/1962 Pavlecka E04C 2/08 52/275
(Continued)

FOREIGN PATENT DOCUMENTS

JP 06049931 2/1994
JP 0624078 8/1994
(Continued)

OTHER PUBLICATIONS

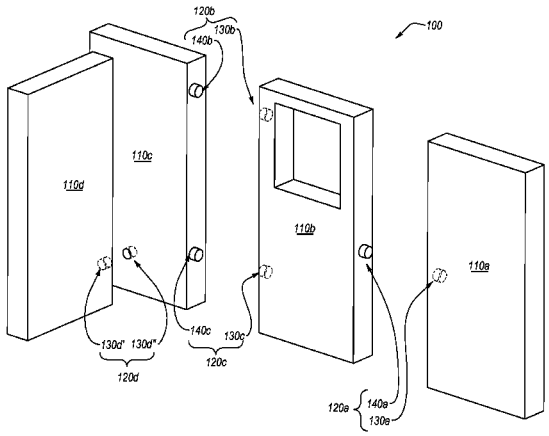
International Search Report and Written Opinion for PCT/US2013/044524 mailed Jun. 6, 2013.
(Continued)

Primary Examiner — James Ference
(74) *Attorney, Agent, or Firm* — Workman Nydegger

(57) **ABSTRACT**

Implementations of the present invention relate to systems, methods, and apparatus for constructing a building. More specifically, the present disclosure provides an interlocking wall system that can allow a builder to accurately position, orient, and/or secure various structural wall modules. Additionally, this disclosure provides systems and methods for securing one or more cladding layers to the building's envelope. Furthermore, implementations of the present disclosure can allow for quick and modifiable installation of utility and communication lines within the building.

20 Claims, 7 Drawing Sheets



(51) **Int. Cl.**

E04C 2/288	(2006.01)
E04F 13/08	(2006.01)
E04B 1/41	(2006.01)
E04C 2/34	(2006.01)
E04B 2/00	(2006.01)
E04B 1/61	(2006.01)

(52) **U.S. Cl.**

CPC ***E04B 1/6145*** (2013.01); ***E04C 2/288*** (2013.01); ***E04C 2/34*** (2013.01); ***E04C 2/46*** (2013.01); ***E04F 13/081*** (2013.01); ***E04F 13/0816*** (2013.01)

(58) **Field of Classification Search**

CPC ... E04C 2/46; E04C 2/34; E04C 2/288; E04C 2/7425; E04C 2/296; E04C 2/049; E04C 2/205; E04C 2/22; E04F 13/0816; E04F 13/081

USPC 52/586.1, 281, 239, 481.1, 794.1, 489.1, 52/506.05, 220.2

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,529,389	A *	9/1970	Wilkins	E04B 1/6125 174/497
3,686,810	A *	8/1972	Allen	E04B 2/78 52/243
4,336,675	A *	6/1982	Pereira	E04B 2/64 52/267
4,545,168	A *	10/1985	Dalton, Jr.	E04B 1/6108 52/239
5,038,539	A *	8/1991	Kelley	A47B 21/06 211/190
5,097,643	A *	3/1992	Wittler	E04B 2/7425 160/135
5,222,902	A *	6/1993	Piersch	A63H 33/062 403/345
5,305,567	A *	4/1994	Wittler	E04B 2/7425 160/135
5,353,562	A *	10/1994	Decker	E04C 2/205 256/31
5,466,086	A *	11/1995	Goto	E04B 1/2604 403/267
5,735,090	A *	4/1998	Papke	E02D 27/00 52/220.2
6,044,609	A *	4/2000	Kim	E04F 13/0864 52/478
6,134,852	A *	10/2000	Shipman	A47B 57/425 52/220.7
6,235,367	B1 *	5/2001	Holmes	E04B 1/14 428/223
6,240,691	B1 *	6/2001	Holzkaemper	E04B 1/942 52/309.8
6,308,491	B1	10/2001	Porter	
6,430,885	B1 *	8/2002	Ito	E04F 13/0812 52/235
6,484,465	B2 *	11/2002	Higgins	E04F 13/083 52/235
6,631,589	B1 *	10/2003	Friedman	B66B 11/0226 187/401
6,647,562	B1 *	11/2003	Arout	E04H 4/0043 4/506
6,679,021	B2 *	1/2004	Maimon	E04C 2/296 52/271
6,860,073	B2 *	3/2005	Chien	E04C 2/521 52/220.1
6,968,661	B2 *	11/2005	Kopish	E04B 2/7457 52/481.1
6,973,756	B2 *	12/2005	Hatzinikolas	E04F 13/0855 52/235
7,165,767	B2 *	1/2007	Graef	G07D 11/0003 109/24.1
8,161,697	B1 *	4/2012	McDonald	E04C 2/16 428/106
2003/0033769	A1 *	2/2003	Record	E04B 1/14 52/270
2003/0110726	A1	6/2003	Rudduck	
2005/0229528	A1 *	10/2005	Kardosz	E04C 3/11 52/639
2006/0230700	A1 *	10/2006	Chen	E04C 2/20 52/586.1
2007/0044411	A1 *	3/2007	Meredith	E04B 1/14 52/586.1
2007/0175158	A1 *	8/2007	Cope	E04B 1/2604 52/585.1
2007/0194672	A1 *	8/2007	Hibicke	H02B 7/08 312/223.1
2007/0251181	A1 *	11/2007	Dupont	E04F 13/0805 52/586.1
2008/0134610	A1 *	6/2008	Jakob-Bamberg	E04B 2/7448 52/489.1
2008/0302037	A1 *	12/2008	Brown	E04B 5/12 52/289
2009/0064627	A1 *	3/2009	Struthers	H02G 1/00 52/714
2009/0193735	A1 *	8/2009	Kalinowski	E04B 2/60 52/281
2009/0251035	A1 *	10/2009	Cash	A47B 47/042 312/265.5
2010/0018146	A1 *	1/2010	Aube	E02D 29/0233 52/483.1
2010/0074683	A1 *	3/2010	Richard	E04B 1/486 403/408.1
2011/0173925	A1 *	7/2011	Brown	E04B 1/14 52/794.1
2011/0290307	A1 *	12/2011	Workman	F24J 2/5211 136/251

FOREIGN PATENT DOCUMENTS

JP	0718936	7/1995
JP	200012980	5/2000

OTHER PUBLICATIONS

European Search Report for application No. 13803755 mailed on Mar. 6, 2016.

* cited by examiner

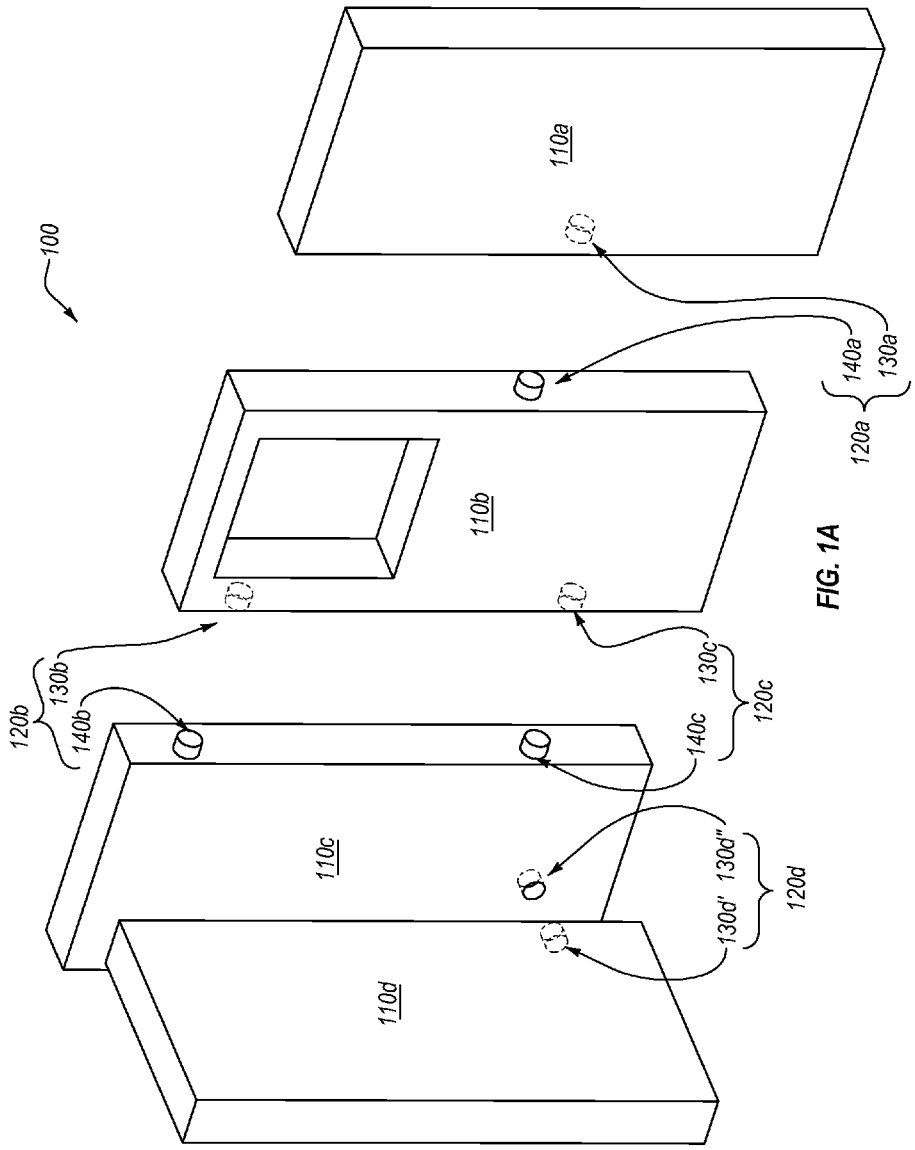

100
110a
140a
130a
120a
110b
130c
120c
140c
120b
130b
140b
110c
130d''
130d'
120d
110d

FIG. 1A

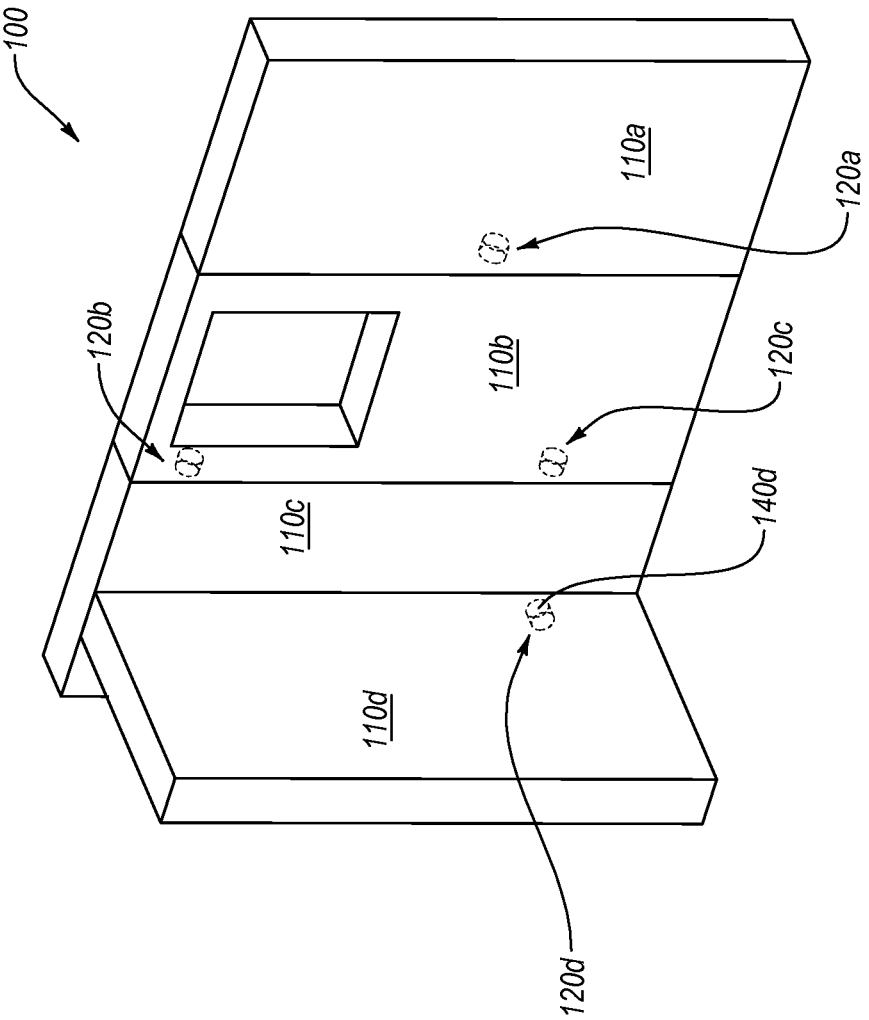


FIG. 1B

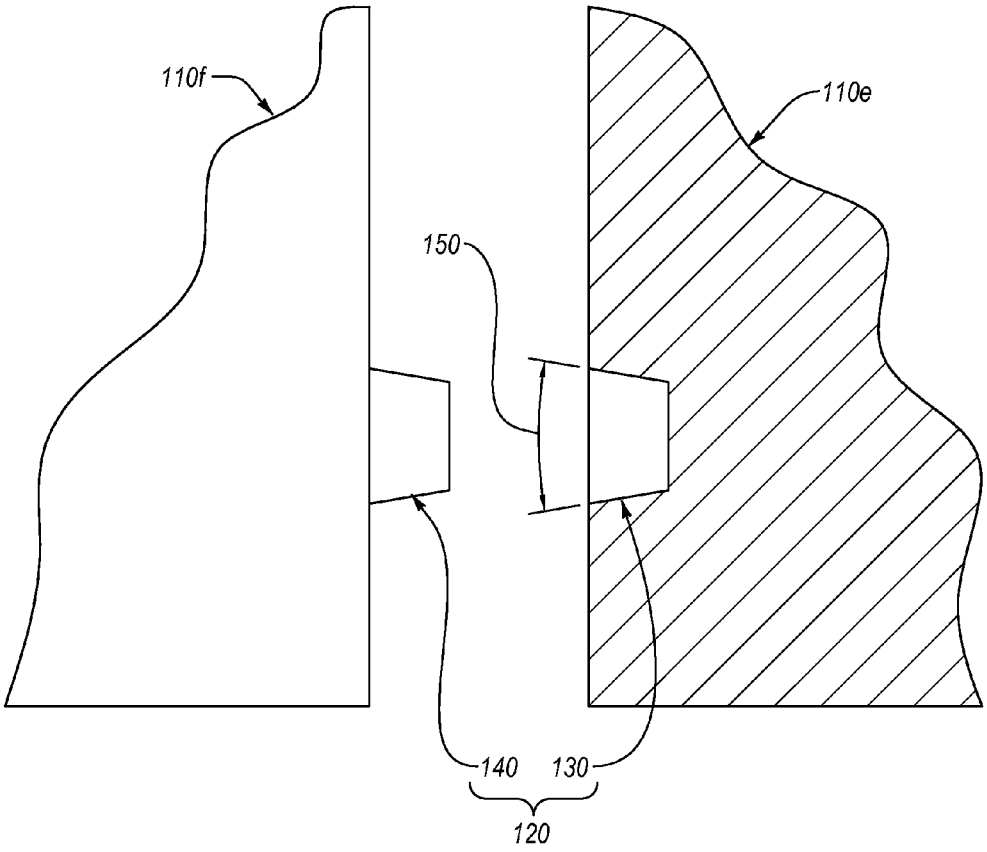


FIG. 2

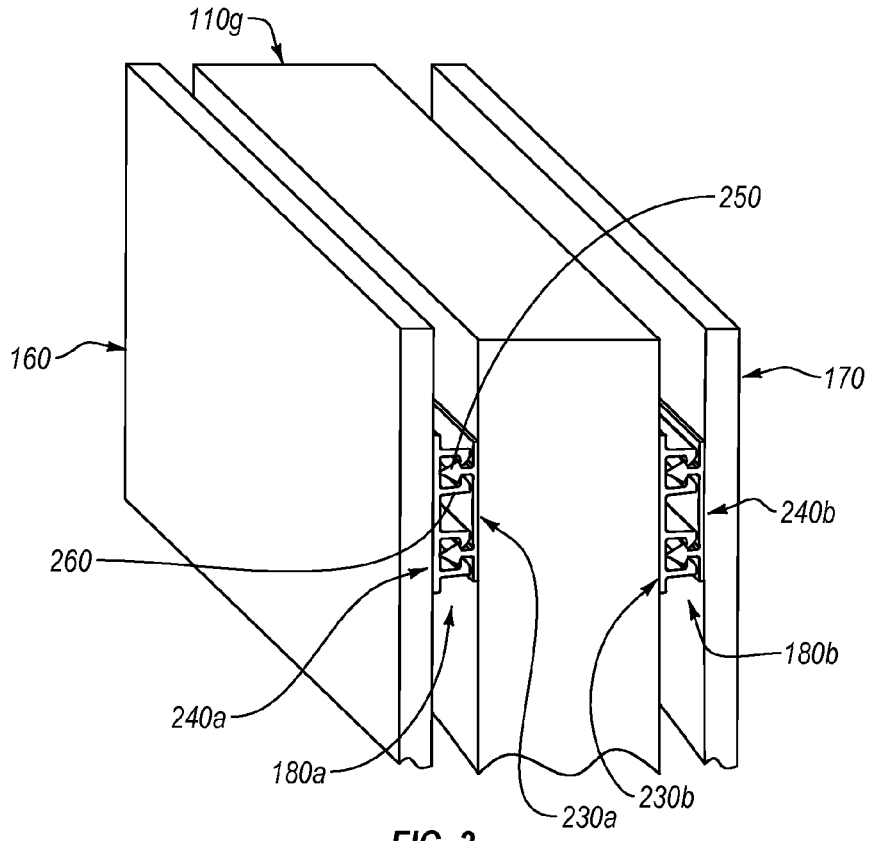

110g
250
160
170
240b
260
180b
240a
180a
230a
230b

FIG. 3

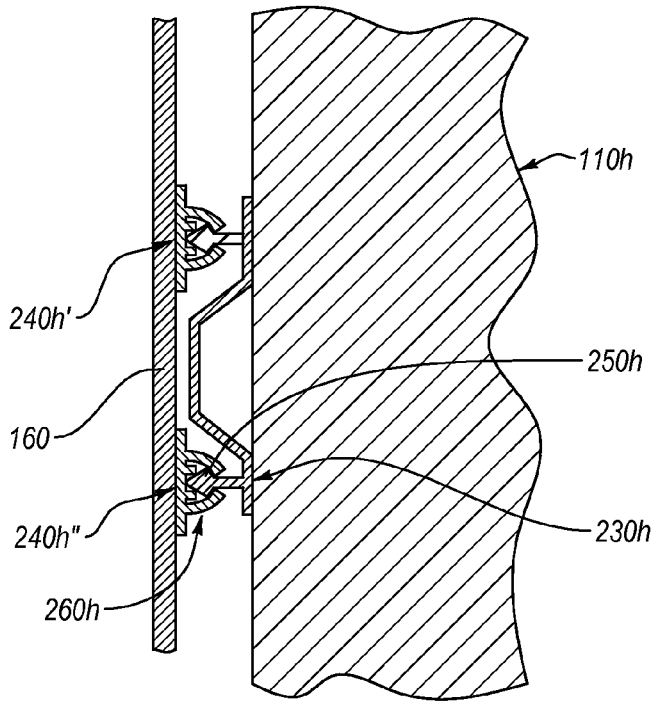

110h
240h'
250h
160
240h"
230h
260h

FIG. 4

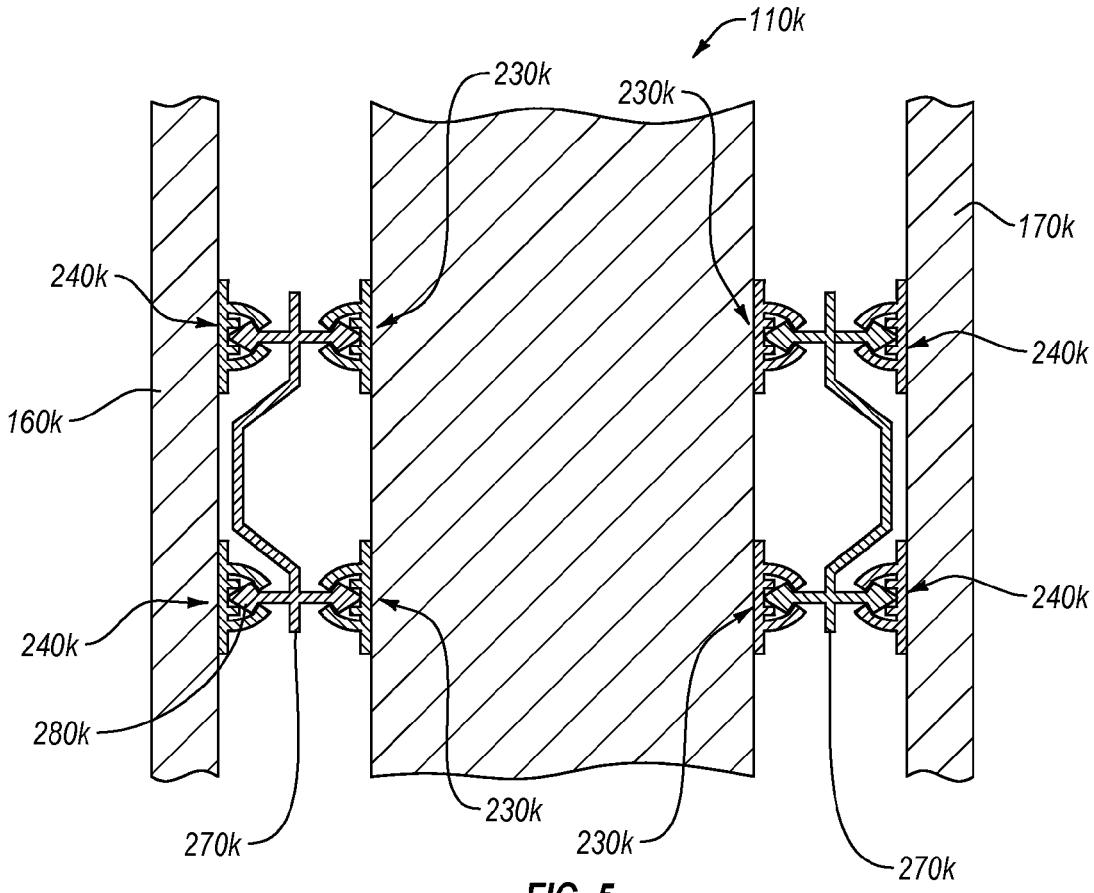

110k
230k
230k
170k
240k
240k
160k
240k
240k
280k
270k
230k
230k
270k

FIG. 5

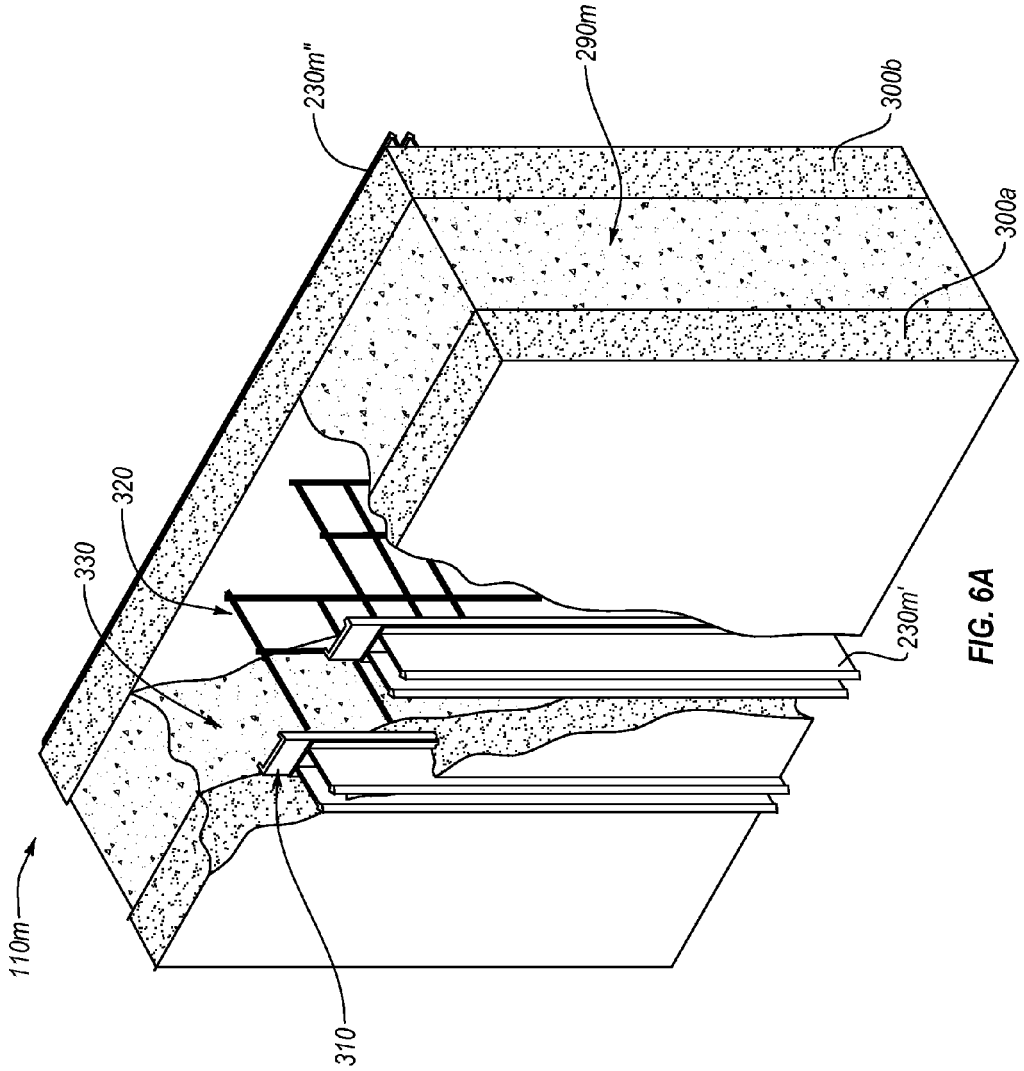


FIG. 6A

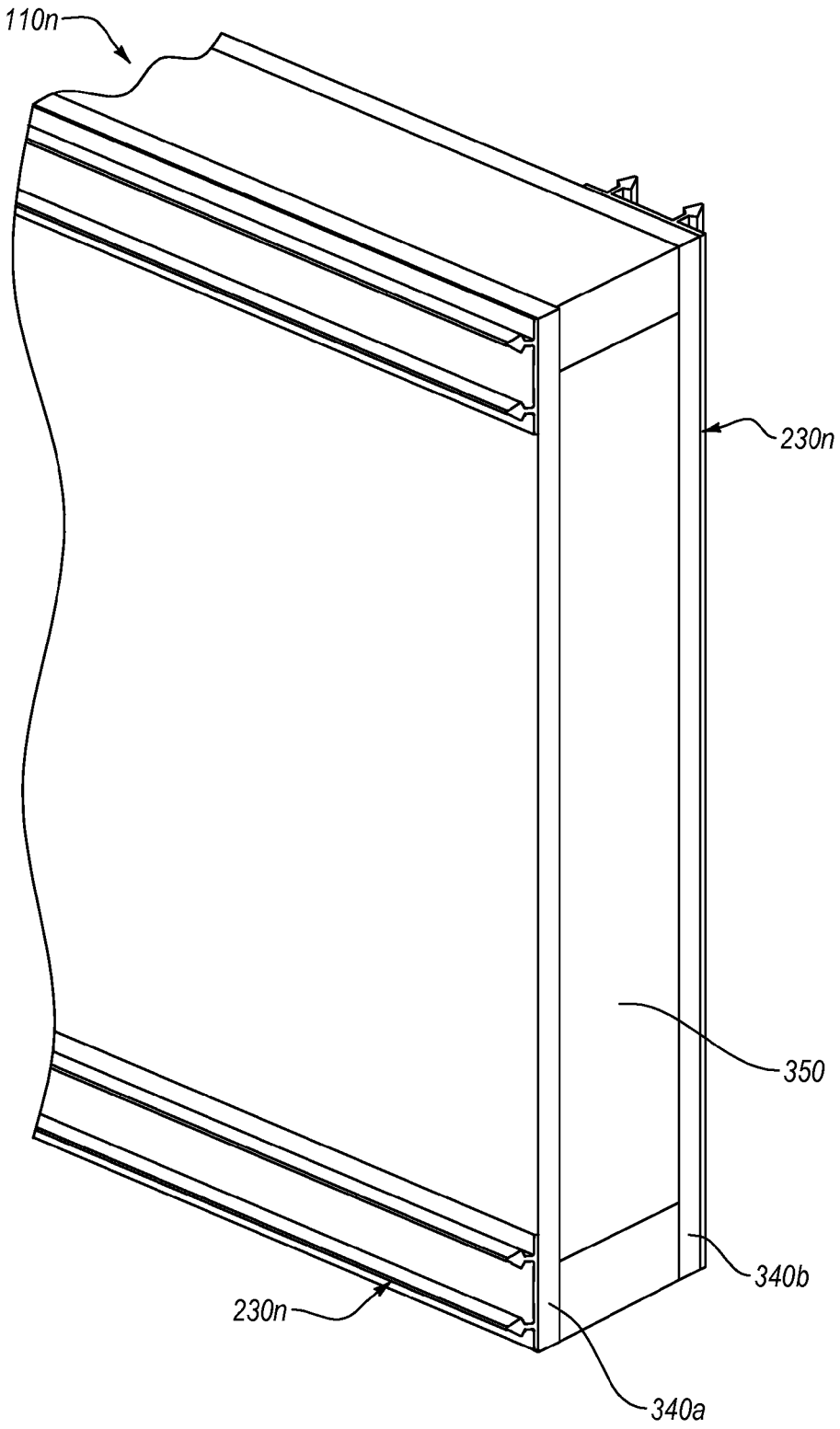


FIG. 6B

MODULAR BUILDING CONSTRUCTION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

The present invention is a 35 U.S.C. §371 U.S. National Stage of PCT Patent Application No. PCT/US2013/044524 filed Jun. 6, 2013, entitled "Modular Building Construction Systems and Methods," which claims the benefit of priority to U.S. Provisional Patent Application No. 61/658,403, filed Jun. 11, 2012, entitled "Modular Building Construction Systems And Methods." The entire content of each of the aforementioned patent applications is incorporated herein by this reference.

BACKGROUND OF THE INVENTION

1. The Field of the Invention

This invention relates to systems, methods, and apparatus for securing trim to interior and exterior portions and walls of a building as well as for aligning and securing together the building's walls.

2. Background and Relevant Art

A typical building construction involves preparing and constructing walls as well as other building elements at a build site. Additionally or alternatively, a builder may choose to use prefabricated wall modules to construct interior and/or exterior walls of the building. Oftentimes, varying levels of worker's skills can result in inconsistent build quality. Furthermore, human error also can affect the quality of construction. For instance, workers can position and/or secure wall modules incorrectly, thereby increasing the amount of finishing work on the building and/or necessitating further modifications to the building.

Once the structural portions of the walls are constructed (i.e., a building envelope is formed), a typical building may incorporate additional features on the walls. For example, the builder may add a cladding layer to the outer surfaces of the building's walls for improved aesthetic appearance as well as weather protection. Similarly, the builder can add a cladding layer to the interior surfaces of the walls. Adding the cladding layer can present particular challenges in construction projects utilizing modular walls, such as structural insulated panels (SIPs) and insulated concrete forms (ICFs), and can be time-consuming and expensive.

Additionally, a typical building includes various utilities and communications, such as plumbing and sewer lines, electrical lines, data and communication lines, etc. Thus, after constructing the building envelope, the builder may have to furnish the building with necessary utilities. Incorporating various utilities in the building usually presents numerous challenges. For instance, housing utility lines within permanent walls may require modifications and/or partial demolition of already constructed portions of the building envelope, which may be time-consuming and expensive to perform. For example, running electrical, plumbing or other utilities through the SIP panels is time consuming and challenging. The use of ICFs requires careful forethought and placement of utility raceways or connectors, as once the concrete is set it is difficult or impossible to access the wall cavity. Even typical stud framed walls cannot be easily accessed once the drywall is applied, without damaging or replacing the drywall.

Accordingly, there are a number of disadvantages in systems and methods for constructing a building that can be addressed.

BRIEF SUMMARY OF THE INVENTION

Implementations of the present invention provide systems, methods, and apparatus for constructing a building. More specifically, in at least one implementation, an interlocking wall system can allow a builder to accurately position and/or secure various structural wall modules. For instance, the builder can position and/or secure structural portions of the building's walls (i.e., structural wall modules), thereby forming a building envelope. The interlocking wall system also can prevent and/or reduce incidents of human error, which can increase accuracy of the constructed building envelope and can reduce time required to complete such construction.

At least one implementation includes an interlocking modular wall system for constructing a building envelope. The interlocking wall system has a first structural wall module including a first interlock positioned at an offset from one or more of a vertical centerline or a horizontal centerline of the first structural wall module. The interlocking wall system also has a second structural wall module including a second interlock positioned at an offset from one or more of a vertical centerline or a horizontal centerline of the second structural wall module. Additionally, the first interlock is connectable with the second interlock, and when connected together, the first and second interlocks orient and position the first structural wall module relative to the second structural wall module.

Implementations also include a quick-connect wall cladding system for providing one or more of improved aesthetic and protection to an exterior wall of a building. The quick-connect wall cladding system includes a structural wall module that has an exterior face that is configured to form at least a portion of the exterior wall of the building. Additionally, the quick-connect wall cladding system includes a plurality of wall-side connectors secured to or incorporated with the structural wall module. The quick-connect wall cladding system includes a cladding layer sized and configured to provide an improved aesthetic and/or protection to the exterior face of the structural wall module. Moreover, the quick-connect wall cladding system has a plurality of cladding-side connectors secured to or incorporated into the cladding layer. The plurality of wall-side connectors and the plurality of cladding-side connectors are connectable together to secure the cladding layer to the structural wall module.

Additional or alternative implementations include an interlocking modular wall system for constructing a building envelope. The interlocking modular wall system has a first structural wall module that includes one or more first interlocking features and one or more first wall-side connectors. The interlocking modular wall system also has a second structural wall module that includes one or more second interlocking features and one or more second wall-side connectors, the one or more second interlocking features being connected to the one or more first interlocking features. Furthermore, the interlocking modular wall system has one or more cladding layers that include cladding-side connectors that are secured thereto or integrated therewith. Also, the cladding-side connectors are connected to one or more of the one or more first wall-side connectors and the one or more second wall side connectors.

Additional features and advantages of exemplary implementations of the invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by the practice of such exemplary implementations. The features and advantages of such implementations may be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims. These and other features will become more fully apparent from the following description and appended claims, or may be learned by the practice of such exemplary implementations as set forth hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to describe the manner in which the above-recited and other advantages and features of the invention can be obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. For better understanding, the like elements have been designated by like reference numbers throughout the various accompanying figures. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

FIG. **1**A illustrates a perspective view of a disassembled interlocking modular wall system in accordance with one implementation of the present invention;

FIG. **1**B illustrates a perspective view of an assembled interlocking modular wall system of FIG. **1**A;

FIG. **2** illustrates a cross-sectional view of matching interlocks in accordance with one implementation of the present invention;

FIG. **3** illustrates a perspective view of a structural wall module in accordance with one implementation of the present invention;

FIG. **4** illustrates a perspective view of a structural wall module in accordance with another implementation of the present invention;

FIG. **5** illustrates a perspective view of a structural wall module in accordance with yet another implementation of the present invention;

FIG. **6**A illustrates a perspective view of an ICF configured structural wall module in accordance with one implementation of the present invention; and

FIG. **6**B illustrates a perspective view of a SIP configured structural wall module in accordance with one implementation of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Implementations of the present invention provide systems, methods, and apparatus for constructing a building. More specifically, in at least one implementation, an interlocking wall system can allow a builder to accurately position and/or secure various structural wall modules. For instance, the builder can position and/or secure structural portions of the building's walls (i.e., structural wall modules), thereby forming a building envelope. The interlocking wall system also can prevent and/or reduce incidents of human error, which can increase accuracy of the constructed building envelope and can reduce time required to complete such construction.

Additional implementations provide for the separation of the cladding or finish materials from the envelope building materials. For example, one or more implementations include exterior and/or interior curtain walls. Such curtain walls may comprise an under-structure that can connect to the wall per the constraints of the building material of the wall, while providing a consistent surface that will accept virtually any finish or finish material.

Still further implementations provide a building envelope (i.e., outer walls) and modular interior walls. The modular interior walls comprise horizontal and vertical frame members to which wall cladding (such as decorative tiles) attach. The building envelope can be devoid of utilities (plumbing, HVAC, electrical, etc.) or have only entry or exit points. The modular interior walls can house the utilities. The ability to easily remove or install the wall cladding on the modular interior walls can facilitate easy access to the utilities. For example, utilities can enter through a basement and extend up into the interior walls. In such implementations, utilities need not penetrate the exterior above-ground walls.

One or more implementations also include a quick-connect cladding systems, which can allow the builder to position and secure various cladding layers to the modular walls of a building structure to form curtain walls. For example, the builder can secure one or more cladding layers to the interior portion of the building's walls using connectors and receivers of the quick-connect cladding system. Similarly, the builder also can secure cladding layers to the exterior of the building's envelope. Furthermore, a manufacturer can prefabricate structural wall modules, such as SIP and/or ICF wall modules, which can incorporate connectors or the quick-connect cladding system, and which can couple to receivers secured to or integrated with the cladding layers. Thus, the builder can secure the cladding layers to the exterior portion of the building envelope, thereby forming the quick-connect cladding system.

Additionally, the interlocking wall system and the quick-connect cladding system together can improve alignment and positioning of the cladding layers. In particular, the manufacturer can prefabricate structural wall modules that incorporate portions of the interlocking wall system as well as portions of the quick-connect cladding system (e.g., connectors). Accordingly, the builder can connect the structural wall modules at predetermined positions, to form the building envelope that also has connectors of the quick connect cladding system at predetermined positions. Thus, the builder can connect the cladding layers to the structural wall modules at predetermined positions, which can allow the builder or an architect to incorporate a consistent and/or matching pattern across the cladding layer.

At least one implementation also includes a modular utility wall system, which can house one or more utility and/or communication lines, such as plumbing, sewer, HVAC ducts, electrical lines, data lines, communication lines, etc., and combinations thereof. In particular, the modular utility wall system can allow the builder to avoid including utility and/or communication lines in the building envelope (i.e., outer walls of a building). For instance, the builder can provide the utility and or communication lines through the modular utility wall system, which can comprise a plurality of modular inner walls. Thus, the builder can avoid modifying the structural walls and/or structural wall modules of the building envelope. Furthermore, the modular utility wall system also can allow the builder to reposition the utility and/or communication lines as well as to provide access to these lines for inspection and/or repair thereof.

Accordingly, the builder can reduce construction time and increase quality of the build by using the interlocking wall system, which can force the builder to position and/or secure structural wall modules at predetermined positions. For instance, as illustrated in FIGS. **1**A and **1**B, an interlocking modular wall system **100** can include multiple structural wall modules (e.g., structural wall modules **110***a*, **110***b*, **110***c*, **110***d*) and one or more matching interlocks that can align and/or connect adjacent wall modules. Specifically, FIG. **1**A illustrates the interlocking modular wall system **100** before assembly, while FIG. **1**B illustrates an assembled interlocking modular wall system **100**. In one example, the interlocking modular wall system **100** can include matching interlocks **120***a* that can align the structural wall module **110***a* and structural wall module **110***b*. Similarly, matching interlocks **120***b*, **120***c* can align adjacent structural wall modules **110***b*, **110***c*, and the matching interlocks **120***d* can align structural wall modules **110***c*, **110***d*.

In at least one implementation, the matching interlocks **120***a*, **120***b*, **120***c*, **120***d* can include a female interlock and a male interlock, such as the female interlocks **130***a*, **130***b*, **130***c* and the male interlocks **140***a*, **140***b*, **140***c*. The male interlocks **140***a*, **140***b*, **140***c* can fit into corresponding female interlocks **130***a*, **130***b*, **130***c*, thereby positioning and orienting adjacent ones of structural wall modules **110***a*, **110***b*, **110***c* relative to each other. For instance, female interlock **130***a* can accept the male interlock **140***a*, thereby positioning and orienting the structural wall module **110***a* with respect to the structural wall module **110***b*.

In additional or alternative implementations, the matching interlocks can include two female interlocks that may accept a connecting or aligning member therebetween. In one example, the matching interlocks **120***d* may include a female interlock **130***d*' and another, opposing female interlock **130***d*". The builder can insert an alignment member **140***d* into one or both of the female interlocks **130***d*', **130**" to align and/or connect the female interlocks **130***d*', **130***d*" together. For instance, to align the structural wall modules **110***c*, **110***d*, the builder can insert the alignment member **140***d* into the female interlock **130***d*', such that the alignment member **140***d* protrudes out of the female interlock **130***d*' and can enter the female interlock **130***d*" when the builder presses together the structural wall modules **110***c* and **110***d*.

The structural wall modules can include any suitable number of matching interlocks on any side thereof. In one example, the structural wall modules can have a single matching interlock pair, such as the matching interlocks **120***a*, which can align the structural wall modules **110***a*, **110***b*. In additional or alternative implementations, multiple interlock pairs can align adjacent structural wall modules. For example, two matching interlocks **120***b*, **120***c* can align structural wall modules **110***b*, **110***c*. In particular, female interlocks **130***b*, **130***c* can accept corresponding male interlocks **140***b*, **140***c*, thereby positioning and orienting the structural wall module **110***b* with respect to the structural wall module **110***c*.

It should be appreciated, however, that any side (i.e., left and right sides, top and bottom, and front and back) of any structural wall module may include any suitable number and combination of male and/or female interlocks. For instance, the structural wall module **110***b* can have male interlock **140***a* on a first side, and female interlocks **130***b*, **130***c* on a second side. Accordingly, a builder can fit the male interlocks **140***a*, **140***b*, **140***c* into the corresponding female interlocks **130***a*, **130***b*, **130***c*, to position and orient the structural wall module **110***b* with respect to the structural wall modules **110***a*, **110***c*.

In one or more implementations, the structural wall modules **110***a*, **110***b*, **110***c*, **110***d* also can have portions of the matching interlocks positioned on a bottom side, a top side, and/or one or more faces of the structural wall module **110**. For instance, the matching interlocks can orient and position any of the structural wall modules **110***a*, **110***b*, **110***c*, **110***d* relative to a base (not shown). In one example, the structural wall modules can incorporate the male and/or female interlocks on the bottom sides thereof, and the base can incorporate corresponding female and/or male interlocks that couple with the male and/or female interlocks on the bottom sides of the structural wall modules, thereby aligning the structural wall modules relative to the base.

In one implementation, the interlocking modular wall system **100** can include the matching interlocks between a face of one structural wall module and a side of another structural wall module. Hence, in some instances, the matching interlocks can facilitate angular alignment between adjacent structural wall modules (e.g., the installer can form a T or L configuration). For example, the builder can position and connect together the structural wall modules **110***c*, **110***d* at a ninety-degree angle (i.e., in a T or L configuration).

As mentioned above, the structural wall module **110***c* can include the male interlocks **140***b*, **140***c* on a first side and a female interlock **130***d*" on a front thereof. The builder can connect the structural wall module **110***d* to the front of the structural wall module **110***c*, aligning the structural wall modules **110***c*, **110***d* with matching interlocks **130***d*', **130***d*". Also, the first side of the structural wall module **110***c* can connect to the second side of the structural wall module **110***b*. Accordingly, the matching interlocks can orient and position multiple structural wall modules, one with respect to another, in various combinations, which can include structural wall modules positioned in-line as well as structural wall modules positioned at various angles with respect to each other. Furthermore, including different interlocks on different sides of the structural wall modules can force the installer to position the structural wall module in a predetermine configuration relative to each other.

In at least one implementation, the manufacturer can position the matching interlocks such that the builder can connect the structural wall modules one to another in a predetermined manner. More specifically, in order to couple the corresponding portions of the matching interlocks (e.g., the female and male interlocks) located on respective structural wall modules, the builder can position the structural wall modules only in a predetermined manner. In other words, particular arrangement or positioning and/or male-female combinations of the interlocks on the structural wall modules can provide for predetermined positioning and orientation of adjacent structural wall modules aligned by such matching interlocks.

For instance, in the example illustrated in FIGS. **1**A-**1**B, the structural wall module **110***b* includes a male interlock **140***a* on a first side. As such, the installer may be forced to connect the right side of the structural wall module **110***b* to the structural wall module **110***a*, which includes a corresponding female interlock **130***a* that can accept the male interlock **140***a*. Similarly, the structural wall module **110***b* can include the female interlocks **130***b*, **130***c* on a second side, which can force the installer to connect the second side of the structural wall module **110***b* to the structural wall module **110***c* that has corresponding male interlocks **140***b*, **140***c*.

Additionally or alternatively, the structural wall modules can have offset matching interlocks, such that the builder can

connect the matching interlocks **120** one to another only in a predetermined manner. As such, the builder may be forced to connect the structural wall modules in a predetermined orientation. For instance, adjacent structural wall modules may include two side matching interlocks positioned at different distances from top and bottom of the structural wall modules. Consequently, positioning one of such structural wall modules upside-down (i.e., top side on the base) can position the matching interlocks out of alignment with each other, which can prevent connecting the structural wall modules together.

The example in FIGS. **1**A-**1**B shows that the distance from the top side of the structural wall module **110***b* to the female interlock **130***b* can be different than the distance from the bottom side of the structural wall module **110***b* to the female interlock **130***c*. Likewise, the structural wall module **110***c* can have similar or the same positioning of the corresponding male interlocks **140***b*, **140***c* from the top and bottom sides thereof. Thus, the builder can align and connect together the structural wall modules **110***b*, **110***c*, as shown in FIG. **1**B.

In addition, some implementations can include matching interlocks positioned at a distance from the front surface of the structural wall module that is different than the distance from back surface. In other words, the structural wall module can include matching interlocks offset from a centerline of the structural wall module. Accordingly, if the builder positions one of adjacent structural wall modules in a flipped orientation, for instance, such that the top side of the flipped structural wall module faces downward, the corresponding portions of the matching interlocks on the adjacent structural wall modules may not align with and each other. Similarly, if rotated (e.g., 180°), such that the front face of one structural wall module is aligned with the back face of the adjacent structural wall module, the corresponding portions of the matching interlocks may not align with and each other and may prevent the builder from making such incorrect connection.

Thus, the matching interlocks can force the builder to orient the structural wall modules in a predetermined orientation. More specifically, the builder may have to align the corresponding portions of the matching interlocks on adjacent structural wall modules in order to connect together such structural wall modules. Notably, the structural wall modules can incorporate portions of the matching interlocks offset from various surfaces and/or sides thereof, such as to force the builder to orient the structural wall modules at a predetermined orientation.

Moreover, the structural wall modules can incorporate portions of the matching interlocks that have different shapes and/or sizes. For instance, the structural wall module can incorporate portions of cylindrical matching interlocks on a first side thereof, and portions of rectangular matching interlocks on a second side thereof. Accordingly, the builder may have to position the structural wall module such that the portions of the cylindrical and rectangular matching interlocks align with the corresponding portions of the cylindrical and rectangular matching interlocks. Therefore, the manufacturer or the architect can incorporate matching interlocks into two or more structural wall modules of the interlocking modular wall system **100**, to ensure accurate positioning and orientation of the structural wall modules. Furthermore, such matching interlocks can ensure proper positioning of two structural wall modules of the interlocking modular wall system **100** as well as any number of the structural wall modules, including all of the structural wall modules in the interlocking wall system.

As described above, in at least one implementation, the matching interlocks can have two portions comprising the male and female interlocks. FIG. **2** illustrates an enlarged partial cross-sectional view of an exemplary matching interlock **120**. It should be appreciated that any of the matching interlocks **120***a*, **120***b*, **120***c*, **120***d* (FIGS. **1**A-**1**B) and their respective materials, elements, or components may be similar to or the same as the matching interlock **120** and its materials, elements and components.

In one or more implementations, the matching interlock **120** includes a female interlock **130** and a male interlock **140**. The female interlock **130** may form a recess and a portion of a structural wall module **110***e*, which can receive the male interlock **140** that can protrude from a portion of a structural wall module **110***f*. Furthermore, the female interlock **130** can have sufficient clearance to facilitate entry of the male interlock **140** as well as to locate the corresponding structural wall modules. For instance, female and male interlocks **130**, **140** can include 0.020" per side clearance therebetween.

As such, the female and male interlocks **130**, **140** may have limited or no freedom of motion relative to each other in at least a two-dimensional plane. In other words, the female and male interlocks **130**, **140** may connect together in a manner that the female and male interlocks **130**, **140** cannot move along at least two axes. Accordingly, the matching interlocks **120** can orient and position adjacent structural wall modules **110***e*, **110***f* along at least two axis (e.g., a first axis that may be perpendicular to front and back surfaces of the structural wall modules and along a second axis that may be perpendicular to left and right sides of the structural wall modules).

In light of this disclosure, those skilled in the art should appreciate that matching interlocks can have other configurations. For instance, as mentioned above, the matching interlocks can comprise two female interlocks and a dowel therebetween. More specifically, a first structural wall module can include a first female interlock recessed therein, and a second structural wall module can include a second female interlock recessed therein. The builder can insert the dowel into the first and the second female interlocks, thereby positioning and orienting the respective first and second structural wall modules. It should be noted that, the female interlocks and the corresponding dowels can have various shapes (e.g., the female interlocks can have rectangular shapes that can accommodate a rectangular dowel, such as a piece of dimensional lumber, circular shapes that can accommodate a round or tubular dowel, such as a pipe, and others).

Furthermore, in one or more implementations, the matching interlocks **120** also can couple or secure the structural wall modules together. For example, the female and male interlocks **130**, **140** can have corresponding locking tapers. More specifically, the female and male interlocks **130**, **140** can incorporate an included angle **150**. For instance, an included angle **150** can be 3°. Accordingly, the female and male interlocks **130**, **140** can couple and lock together on the locking taper, thereby securing the respective structural wall modules **110***e*, **110***f*.

Additionally or alternatively, portions of the matching interlocks can have an interference fit one with another to secure the respective structural wall modules together. Moreover, the matching interlocks can incorporate various features that can allow portions of the matching interlocks located on adjacent structural wall modules to couple one to another, thereby securing the adjacent matching interlocks one to another. For instance, portions of the matching

interlocks can have snap-fit features, that snap together to secure the corresponding portion of the matching interlocks.

A builder can employ any number of suitable mechanisms to temporarily and/or permanently secure structural wall modules together. Moreover, in addition to or in lieu of connection features described above, the structural wall modules can have other features and/or elements that can secure one structural wall module to another. For example, the structural wall modules can include retention mechanisms more fully described in U.S. Pat. No. 7,832,154, entitled "Position Retention Mechanism for Modular Wall Assembly," and in U.S. Pat. No. 7,984,598, entitled "Position Retention Mechanism for Modular Wall Assembly," the entire contents of which are incorporated herein by reference. The structural wall modules can include such retention mechanisms in lieu of or in addition to matching interlocks.

In at least one implementation, the structural wall modules can include prefabricated wall modules such as wall modules comprising SIP and/or ICF walls. The manufacturer can place window and/or door openings as well as other components in the structural wall modules at the factory. The manufacturer also can attach matching interlocks to the structural wall modules.

In addition, the structural wall modules can include matching interlocks that interface with non-structural wall modules (e.g., divider walls inside the building envelope). Hence, the manufacturer also can include corresponding portions of the matching interlocks on the non-structural wall modules, which the manufacturer can provide at the build site. As such, the manufacturer can ensure that the builder properly positions and orients the non-structural wall modules relative to the structural wall modules as well as relative to one another. In any case, the manufacturer can use the matching interlocks to ensure that a worker cannot flip, rotate, or otherwise change the orientation and/or order of various wall modules. Thus, the matching interlocks can help ensure that a desired design is followed at the construction site.

In addition to ensuring proper orientation and order of structural and/or non-structural wall modules, the matching interlocks can also ensure that the wall modules are properly aligned. For example, the positioning of the matching interlocks can ensure that the outer surfaces of adjacent wall modules are flush and aligned. This can reduce the need to patch or otherwise fix misalignment of wall modules using time consuming techniques.

The matching interlocks also are optionally independent from any bridging components (such as a beam above and/or below) or additive assumptive methods (such as all panels held sequentially in place, assumed to be immovable because of the ending condition of the entire run) to structurally connect adjacent panels. The forcing functions and specific matching interlocks can be specific to the building materials used for the building envelope. In other words, implementations can include structural wall modules that have matching interlocks that can facilitate alignment and/or positioning of other building elements connected to or interfacing with the building envelope, such as cladding layers, utility lines, and the like.

As illustrated in FIGS. **3**-**6**B, in one or more implementations, the structural wall modules can incorporate one or more portions of a quick-connect cladding system to attach one or more cladding layers to the building envelope formed in the form of curtain walls. More specifically, FIG. **3** illustrates a structural wall module **110***g* and interior and exterior cladding layers **160**, **170** secured to the structural wall module **110***g* with respective quick-connect assemblies **180***a*, **180***b*. Except as otherwise described herein, the structural wall module **110***g* and its materials, elements, or components can be similar to or the same as any of the structural wall modules **110***a*, **110***b*, **110***c*, **110***d*, **110***e*, **110***f* (FIGS. **1**A-**2**) and their respective materials, elements, and components. In one implementation, the structural wall module **110***g* can include various brackets and/or connectors for connecting the cladding layers **160**, **170**.

For instance, the structural wall module **110***g* can include wall-side connectors **230***a*, **230***b* secured thereto, as described in more detail below. Similarly, the cladding layers **160**, **170** can include receivers or connectors, which can accept or couple to connectors secured to the structural wall module **110***g*. In one example, the cladding layers **160**, **170** include cladding-side connectors **240***a*, **240***b*, which can connect to the corresponding wall-side connectors **230***a*, **230***b*.

It should be appreciated that the wall-side connectors **230***a*, **230***b* and the corresponding cladding-side connectors **240***a*, **240***b* can have any number of suitable positions and orientations. FIG. **3** illustrates the wall-side and the cladding-side connectors **230***a*, **230***b*, **240***a*, **240***b* oriented approximately horizontally. In additional or alternative implementations (and as described further below) the wall-side connectors and corresponding cladding-side connectors can have vertical, angled or any number of orientations relative to the wall module and/or relative to a base or foundation.

In one or more implementations, the wall-side connectors **230** can include one or more connection features **250** that can couple with corresponding connection features **260**, coupled to or incorporated into the cladding-side connectors **240**. The connection features **260**, for instance, can include undercutting portions that can secure the connection features **250**. Furthermore, the connection features **250** and **260** can have interchangeable profiles.

In addition, as mentioned above, the wall-side and the cladding-side connectors may be interchangeable. In one example, as shown in FIG. **3**, wall-side connectors **230***a* may be male-type connectors, while the cladding-side connectors **240***a* may be female-type connectors, which can accept a portion of the male-type wall-side connectors **230***a*. Alternatively, wall-side connectors **230***b* may be female-type connectors that can accept a portion of male-type cladding-side connectors **240***b*. In any event, wall-side and cladding-side connectors can connect and couple together to secure the cladding layers to the structural wall module.

Moreover, the connection features **250** and/or **260** can have any number of suitable configurations that can allow the wall-side and the cladding-side connectors **230***a*, **230***b*, **240***a*, **240***b* to connect together and secure the cladding layers **160**, **170** to the structural wall module **110***g*. For example, one of the connection features can have grooves, while another of the connection features can include spring-loaded balls that can fit into such grooves. Connection features also may include barbs and corresponding openings that can secure such barbs. Furthermore, the connection features can have corresponding locking tapers, similar to the locking tapers described above in connection with the matching interlocks **120** (FIG. **3**).

In at least one implementation, a manufacturer can supply modular walls at the factory with preinstalled wall-side connectors **230***a*, **230***b*. Then, at the building site, an installer can quickly and easily attach cladding layers **160**, **170** to the wall-side connectors **230***a*, **230***b*. One will appreciate that by prefabricating the structural wall modules with wall-side

connectors, such as the wall-side connectors **230***a*, **230***b*, the time necessary for constructing the building at the site can be greatly reduced.

In any event, the wall-side and cladding-side connectors **230***a*, **230***b*, **240***a*, **240***b* can allow the builder to snap-in the cladding layers **160**, **170** to the structural wall module. Accordingly, the builder can quickly and easily secure the cladding layers **160**, **170** to the structural wall module **110***g*. Moreover, locations and orientations of the wall-side connectors **230***a*, **230***b* and the cladding-side connectors **240***a*, **240***b* can force the builder to position and orient the cladding layers **160**, **170** at predetermined positions and orientations, which can minimize or eliminate installation mistakes.

As described above, the cladding layer **160** can form an outer surface of the building (e.g., stucco, brick, etc.), which can provide aesthetic properties as well as weatherproofing for the building. Similarly, the cladding layer **170** can form an interior curtain wall on the building's walls (e.g., drywall, decorative tiles, etc.). Hence, by interconnecting structural wall modules and securing the exterior and interior cladding layers to the structural wall modules, the builder can quickly complete and finish the building envelope.

Additional implementations can include structural wall modules and modular walls that can allow the builder the incorporate various utility and/or communication lines. For instance, the wall-side and cladding-side connectors **230***a*, **230***b*, **240***a*, **240***b* can provide space between the structural wall module **110***g* and the cladding layers **160**, **170**. The space between the structural wall module **110***g* and the cladding layers **160** and/or **170** can accommodate the utility lines and systems. Examples of utility and communication lines include plumbing and sewer lines, HVAC ducts, electrical power lines and outlets, data and other network lines, etc.

Specifically, the builder can incorporate the utility and/or communication lines into the structural wall modules as well as into the modular inner walls, prior to and/or after securing respective cladding layers **160** and/or **170** to the structural wall module **110***g*. Furthermore, the builder can remove the cladding layers **160** and/or **170** or portions thereof from the structural wall module **110***g* to allow inspection of the utility and/or communication lines installed therein. Hence, the modular utility wall system can reduce the time and cost associated with installing utility and communication lines within the building.

Moreover, the space can separate the interior and/or exterior cladding behavior from the modular walls or building envelope. In other words, space can at least partially isolate effects on the interior and/or exterior cladding layers by their respective environments from transmission to the structural wall module. For instance, the spaces can substantially reduce sound transmission, due to the separation of cladding layers from the surface of the structural wall module by the quick-connector assemblies and the mass of the cladding layers.

As noted above, the quick-connector assemblies can vary from one implementation to the next. In some instances, a single wall-side and/or cladding-side connector can incorporate multiple connection features. For instance, FIG. **4** illustrates a structural wall module **110***h*, which includes cladding-side connectors **240***h*', **240***h*", each having a single connection feature. Except as otherwise described herein, the structural wall module **110***h* and its materials, elements, or components can be similar to or the same as any of the structural wall modules **110***a*, **110***b*, **110***c*, **110***d*, **110***e*, **110***f*, **110***g* (FIGS. **1A-3**) and their respective materials, elements, and components.

The cladding-side connectors **240***h*', **240***h*" can couple to a wall-side connector **230***h*. More specifically, the cladding-side connectors **240***h*', **240***h*" can include respective connecting features **260***h*, which can connect to connecting features **250***h* of the wall-side connector **230***h*. In other words, a single wall-side connector, such as the wall-side connector **230***h*, can connect to multiple cladding-side connectors (e.g., two cladding-side connectors **240***h*', **240***h*") and vice versa. Accordingly, the manufacturer can place any suitable number of cladding-side connectors and/or wall-side connectors, each of which can include any suitable number of connecting features, which may vary from one implementation to another.

As described above, one of the cladding-side or the wall-side connectors may be a female-type connector, while the other, corresponding connector may be a male-type connector. In some implementation, both cladding-side and wall-side connectors may be female-type connectors. For instance, FIG. **5** illustrates a structural wall module **110***k* and cladding layers **160***k*, **170***k* connected thereto. Except as otherwise described herein, the structural wall module **110***k* and its materials, elements, or components can be similar to or the same as any of the structural wall modules **110***a*, **110***b*, **110***c*, **110***d*, **110***e*, **110***f*, **110***g*, **110***h* (FIGS. **1A-4**) and their respective materials, elements, and components.

In one implementation, the structural wall module **110***k* includes female-type wall-side connectors **230***k* coupled to female-type cladding-side connectors **240***k*. Particularly, an interconnector **270***k* can couple together the wall-side and the cladding-side connectors **230***k*, **240***k*. In one example, the interconnector **270***k* can include opposing male-type connection features **280***k*, which can connect to the wall-side and cladding-side connectors **230***k*, **240***k*, thereby coupling together the wall-side and cladding-side connectors **230***k*, **240***k*.

In some implementations, the interconnector **270***k* can have directly opposing connection features **280***k*. Accordingly, the builder can align the wall-side and cladding-side connectors **230***k*, **240***k* directly opposite to one another. Alternatively, the connections features on one side of the interconnector **270***k* can be offset relative to the connection features on the opposite side thereof. As such, the interconnector **270***k* can compensate for any misalignment between the cladding layer and the structural wall module as well as can offset the cladding layer relative to the structural wall module.

Additionally, the cladding layers may connect together to form one or more curtains. Also, interconnected structural wall modules can form structural modular walls that can include curtains on one or both sides thereof. In one or more implementations, the structural wall modules may include SIP or ICF configured wall modules. FIGS. **6A-6B** illustrate respective ICF configured and SIP configured structural wall modules **110***m*, **110***n*. Except as otherwise described herein, the structural wall modules **110***m*, **110***n* and their respective materials, elements, or components can be similar to or the same as any of the structural wall modules **110***a*, **110***b*, **110***c*, **110***d*, **110***e*, **110***f*, **110***g*, **110***h*, **110***k* (FIGS. **1A-5**) and their respective materials, elements, and components.

For example, as shown in FIG. **6A**, the ICF configured structural wall module **110***m* can include a structural inner layer **290***m* surrounded by insulating layers **300***a*, **300***b*. The structural inner layer **290***m* can include supporting webbing **310** and/or reinforcement bars **320** encased in concrete **330**. As described above, the wall-side connectors can connect to the structural wall module in any number of suitable locations and configurations.

In one example, wall-side connectors **230***m*', **230***m*" can couple to or can be incorporated into the supporting webbing **310** and/or the reinforcement bars **320** of the ICF configured structural wall module **110***m*. For example, the supporting webbing **310** can comprise thermoplastic material, such as polypropylene, which the manufacturer can mold over the wall-side connectors **230***m*', **230***m*". In one implementation, a portion of the wall-side connectors **230***m*', **230***m*" can enter the structural inner layer **290***m*, such that, for instance, the concrete **330** can encase at least a portion of the wall-side connectors **230***m*', **230***m*".

The wall-side connectors **230***m*', **230***m*" can comprise material that can be the same as or different from the material of the supporting webbing **310**. It should be noted that the supporting webbing **310** also can comprise metal, such as steel or aluminum. Thus, the manufacturer can incorporate the wall-side connectors **230***m*', **230***m*" into the support webbing **310** and/or into the reinforcement bars **320**, which can comprise the same material (e.g., steel, aluminum, etc.). In any event, the wall-side connectors **230***m*', **230***m*" can attach to the structural wall module **110***m* in any number of suitable configurations, positions, and orientations (e.g., vertical, horizontal, etc.), which can vary from one implementation to another.

FIG. **6**B illustrates the SIP configured structural wall module **110***n*, which can have outer supporting layers **340***a*, **340***b* and an inner insulating layer **350**. Additionally, in one or more implementations, the structural wall module **110***n* can include wall-side connectors **230***n*. Moreover, the wall-side connectors **230***n* may attach to the structural wall module **110***n* in any number of suitable configurations, positions, and orientations (e.g., vertical, horizontal, etc.), which can vary from one implementation to another.

In one or more implementations, the manufacturer can secure the wall-side connectors **230***n* on and/or to the outer supporting layers **340***a* and/or **340***b* of the structural wall module **110***n*. For instance, the manufacturer can secure the wall-side connectors **230***n* to an outer surface of one or more of the outer supporting layers **340***a*, **340***b*. Additionally or alternatively, the manufacturer can secure wall-side connectors **230***n* on the inner surfaces of one or more outer supporting layers **340***a*, **340***b* (i.e., surfaces facing the inner insulating layer **350**). Thus, for example, the connection features of the wall-side connectors **230***n* can protrude through the supporting layers **340***a* and/or **340***b*.

In addition, the building can include one or more modular inner walls, as more fully described in U.S. Pat. No. 8,024,901, entitled "Integrated Reconfigurable Wall System," the entire content of which is incorporated herein by this reference. Accordingly, the builder can incorporate the desired utility and/or communication lines within the modular inner walls of the building, and can avoid incorporating such utility and/or configuration lines within the building envelope.

For instance, the builder can complete installation of the utility and communication lines within the structural wall modules and modular walls and/or within the modular inner walls of the building and can leave one or more of cover tiles unattached to the modular inner wall. Hence, the utility and communication lines can remain partially exposed. Accordingly, the builder can allow access to the installed utility and communication lines for inspection and modifications. Thus, the builder can complete installation of the utility and communication lines on a preset schedule and may not need to work according to a schedule setup by inspectors.

Having the utilities within the interior modular walls can eliminate the need for dealing with utilities in the exterior walls, increasing the speed of construction and eliminating the challenges/time/errors related to such. In addition, the use of modular electrical componentry within modular walls (easily accessible through removable cladding tiles) simplifies the electrical installation and speeds up the electrical installation. Work can be completed irrespective of electrical inspection schedules, as tiles can simply be left off one side of the wall for inspection, or even removed when required for such. Other utilities such as HVAC or plumbing can also be run modularly through the internal walls.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes that come within the meaning and range of equivalency of the claims are to be embraced within their scope.

We claim:

1. An interlocking modular wall system for constructing at least a portion of a building, the interlocking modular wall system comprising:

a first structural wall module including a first interlock positioned at an offset from one or more of a vertical centerline or a horizontal centerline of the first structural wall module, wherein:

a first cladding portion attached to a first side of the first structural wall module comprises an external surface of a building, wherein the first cladding portion is attached to the first side of the first structural wall via a double-sided interconnector having first and second directly opposing connecting features, the first directly opposing connecting feature connecting to an interior surface of the building and the second directly opposing connecting feature connecting to an interior surface of the first cladding portion, and

a second cladding portion attached to a second side of the first structural wall module comprises an internal surface of the building; and

a second structural wall module including a second interlock positioned at an offset from one or more of a vertical centerline or a horizontal centerline of the second structural wall module, wherein:

the first interlock is connectable with the second interlock;

when connected together, the first and second interlocks orient and position the first structural wall module relative to the second structural wall module in a specified position;

the first and second interlocks are positioned at different offset distances from a top and bottom of the structural wall modules, such that alternate orientations of the first and second structural wall modules are prevented;

a third cladding portion attached to a first side of the second structural wall module comprises another external surface of the building, and

a fourth cladding portion attached to a second side of the second structural wall module comprises another internal surface of the building.

2. The interlocking modular wall system as recited in claim **1**, wherein:

one or more of the first structural wall module and the second structural wall module includes one or more openings sized and configured for a door or a window; and

when connected together, the first and second interlocks orient and position the one or more openings at predetermined positions and orientations.

3. The interlocking modular wall system as recited in claim 1, further comprising:

a third structural wall module including a third interlock positioned at an offset from one or more of a vertical centerline or a horizontal centerline of the third structural wall module, wherein the first structural wall module includes a fourth interlock positioned at an offset from one or more of the vertical centerline or the horizontal centerline of the first structural wall module, the fourth interlock being connectable with the third interlock and having a different offset from one or more of the vertical centerline or the horizontal centerline than the first interlock.

4. The interlocking modular wall system as recited in claim 1, wherein the first interlock is a female interlock and the second interlock is a male interlock sized and configured to at least partially enter the female interlock.

5. The interlocking modular wall system as recited in claim 4, wherein the male interlock and the female interlock have corresponding snap-fit connections.

6. The interlocking modular wall system as recited in claim 1, wherein the first interlock is a female interlock and the second interlock is a female interlock, and the interlocking wall system includes a dowel sized and configured to fit within the first and second interlocks.

7. The interlocking modular wall system as recited in claim 1, wherein one or more of the first and second structural wall modules comprise a SIP configured wall module.

8. An interlocking modular wall system for constructing a building, the interlocking modular wall system comprising:

a first structural wall module including one or more first interlocking features and one or more first wall-side connectors, wherein:

a first side of the first structural wall module comprises an exterior surface of the building to which a first cladding is attachable, wherein the first cladding is attached to the first side of the first structural wall via a double-sided interconnector having first and second directly opposing connecting features, the first directly opposing connecting feature connecting to an interior surface of the building and the second directly opposing connecting feature connecting to an interior surface of the first cladding, and

a second side of the first structural wall module comprises an interior surface of the building to which a second cladding is attachable; a second structural wall module including one or more second interlocking features and one or more second wall-side connectors, the one or more second interlocking features being connectable to the one or more first interlocking features, the first and second interlocking features being configured to orient and position the first structural wall module relative to the second structural wall module in a specified position, the first and second interlocking features being positioned at different offset distances from a top and bottom of the structural wall modules, such that alternate orientations of the first and second structural wall modules are prevented, wherein the first structural wall module is separate from the second structural wall module; and

one or more cladding layers including cladding-side connectors secured thereto or integrated therewith, wherein:

the cladding-side connectors are connectable to one or more of the one or more first wall-side connectors and the one or more second wall side connectors.

9. The interlocking modular wall system as recited in claim 8, wherein a first cladding layer of the one or more cladding layers is connected to an exterior side of one or more of the first structural wall module and the second structural wall module.

10. The interlocking modular wall system as recited in claim 8, wherein the cladding-side connectors and the one or more first and second wall-side connectors form a space between the cladding layer and the first and second structural wall modules.

11. The interlocking modular wall system as recited in claim 10, further comprising one or more utility lines or communication lines located in the space between the cladding layer and one or more of the first and second structural wall modules.

12. An interlocking modular wall system for constructing at least a portion of a building, the interlocking modular wall system comprising:

a first structural wall module including a first interlock positioned at an offset from one or more of a vertical centerline or a horizontal centerline of the first structural wall module, wherein:

a first cladding portion attached to a first side of the first structural wall module comprises an external surface of a building, wherein the first cladding portion is attached to the first side of the first structural wall via a double-sided interconnector having first and second directly opposing connecting features, the first directly opposing connecting feature connecting to an interior surface of the building and the second directly opposing connecting feature connecting to an interior surface of the first cladding portion, and

a second cladding portion attached to a second side of the first structural wall module comprises an internal surface of the building;

a second structural wall module including a second interlock positioned at an offset from one or more of a vertical centerline or a horizontal centerline of the second structural wall module, wherein:

the first interlock is connectable with the second interlock;

when connected together, the first and second interlocks orient and position the first structural wall module relative to the second structural wall module in a specified position;

the first and second interlocks are positioned at different offset distances from a top and bottom of the structural wall modules, such that alternate orientations of the first and second structural wall modules are prevented;

a third cladding portion attached to a first side of the second structural wall module comprises another external surface of the building, and

a fourth cladding portion attached to a second side of the second structural wall module comprises another internal surface of the building; and

a third structural wall module including a third interlock positioned at an offset from one or more of a vertical centerline or a horizontal centerline of the third structural wall module, wherein the first structural wall module includes a fourth interlock positioned at an offset from one or more of the vertical centerline or the horizontal centerline of the first structural wall module, the fourth interlock being

connectable with the third interlock and having a different offset from one or more of the vertical centerline or the horizontal centerline than the first interlock.

13. The interlocking modular wall system as recited in claim **12**, wherein:

one or more of the first structural wall module, the second structural wall module and the third structural wall module includes one or more openings sized and configured for a door or a window; and

when connected together, the first, second and third interlocks orient and position the one or more openings at predetermined positions and orientations.

14. The interlocking modular wall system as recited in claim **12**, wherein the first interlock is a female interlock and the second interlock is a male interlock sized and configured to at least partially enter the female interlock.

15. The interlocking modular wall system as recited in claim **14**, wherein the male interlock and the female interlock have corresponding snap-fit connections.

16. The interlocking modular wall system as recited in claim **12**, wherein the first interlock is a female interlock and the second interlock is a female interlock, and the interlocking wall system includes a dowel sized and configured to fit within the first and second interlocks.

17. The interlocking modular wall system as recited in claim **12**, wherein one or more of the first and second structural wall modules comprise a SIP configured wall module.

18. The interlocking modular wall system as recited in claim **12**, further comprising one or more cladding layers, wherein a first cladding layer of the one or more cladding layers is connected to an exterior side of one or more of the first structural wall module, the second structural wall module or the third structural wall module.

19. The interlocking modular wall system as recited in claim **18**, wherein the one or more cladding layers include cladding-side connectors secured thereto or integrated therewith, the cladding-side connectors and one or more first and second wall-side connectors forming a space between the cladding layer and the first, second or third structural wall modules.

20. The interlocking modular wall system as recited in claim **19**, further comprising one or more utility lines or communication lines located in the space between the cladding layer and one or more of the first, second or third structural wall modules.

* * * * *