MODULAR CONSTRUCTION AND METHOD FOR INSTALLING THE SAME

Field of Invention

The invention relates to building construction techniques. Particularly, the invention relates to the use of modular structure in building construction.

Background

In the construction industry, faster construction and shorter construction period is always desired, thereby the operation cost is reduced. Prefabricated prefinished volumetric construction is widely used in the construction industry to accelerate the construction process. However, the transportation of individual modules from the factories to the construction site tends to be slow and expensive. Therefore, prefabricated modular construction has emerged that a plurality of living module may be retractably nested within one module to be transported together, providing easy transportation and rapid deployment.

However, the dimensions of one or more modules are limited by the dimensions of the interior space of a larger module in order for the one or more modules to be nested within the larger module. Further, there is usually spaces overlapping between modules which limits the total living space that a retractable modular structure may provide. Also, the interior floors of the modules are not flush with each other, resulting in discontinuity between segments of the living space.

It would therefore be desirable to provide a modular structure which could overcome or alleviate the aforementioned disadvantages.

Summary of Invention

In a first aspect, the invention provides a modular structure, comprising a first module and a second module rotatably coupled to the first module by a rotational engagement. The first module is arranged to be hooded within the second module when the modular structure is in a hooded position. The first and second modules are arranged to rotate relative to each other from the hooded position to an open position. The rotational engagement is arranged to allow the first and second modules to rotate about an axis that is adjacent and parallel to a first bottom edge of the first module.

Accordingly, the hooding arrangement and the rotational engagement where the axis is adjacent and parallel to the first bottom edge of the first module may provide that the first module is not fully enclosed within the interior space of the second module such that the dimensions of the first module are not limited to the interior space dimensions of the second module. This may provide more freedom to design the dimensions of each module for specific scenarios. This is different from the prior art where one module needs to be dimensioned smaller than the interior space of another larger module in order for the smaller module to be nested into the larger module.

Also, the retractable nature of the modular structure may provide an easy and safe transportation approach of two units of living space as one single module from the factory to the construction site, which further allows rapid deployment of living units on site, thereby reducing the cost of transportation and on-site deployment whilst maximizing the living space.

In one embodiment of the present invention, the first module may be unhooded by the second module such that the modular structure is configured to be in the open position.

In a further embodiment of the present invention, the axis is adjacent and parallel to a second bottom edge of the second module. The second bottom edge may aligns with the first bottom edge, when the modular structure is in the open position.

In still a further embodiment of the present invention, the axis may be adjacent to an interior space of the first module.

Accordingly, having the axis adjacent to the interior spaces of the first and second modules separates the rotational engagement from the interior living spaces provided by both modules, and avoids overlap between the interior spaces of the first and second modules when the modular structure is in open position, thereby the living space may be further maximized.

In a further embodiment of the present invention, the first module may be arranged to be fully enclosed within the interior space of the second module when the modular structure is in the hooded position.

In still a further embodiment, an interior floor of the first module may be flush with an interior floor of the second module, when the modular structure is in the open position.

Accordingly, the interior spaces of the first and second modules may be smoothly connected as the interior floors of the first and second modules flush with each other at the same level, providing a spacious and continuous living space.

In still a further embodiment, the second module may be arranged to be of the same dimensions as a standard shipping container.

In a second aspect, the invention provides a building structure, comprising a plurality of modular structures. The modular structures are arranged to be adjacent to each other. At least one edge of one modular structure is aligned with a corresponding edge of the adjacent modular structure. .

In one embodiment of the building structure, at least one modular structure may be arranged to be stacked vertically on top of another modular structure.

Brief Description of Drawings

It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible, and consequently the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figure 1 shows a perspective view of a modular structure according to one embodiment of the present invention;

Figure 2A to 2C show the process of transformation of the modular structure from a hooded position to an open position according to one embodiment of the present invention;

Figure 3A to 3B show elevation views of the modular structure in the hooded position and the open position, respectively, according to one embodiment of the present invention;

Figure 4 shows an elevation views of the modular structure in the open position and the second module of the modular structure is covered with an external roof.

Figure 5A to 5C show schematic views of the rotational engagement between the first module and the second module of the modular structure, whereby the modular structure is transformed from the hooded position to the open position according to one embodiment of the present invention;

Figure 6 shows a schematic plan view of a derived modular structure constructed by two modular structures positioned adjacent to each other;

Figure 7 shows a schematic elevation view of a multi-storey building structure constructed from a plurality of modular structures.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

Detailed Description

With reference to Figures 1 to 4, a modular structure 100 is provided having a first module 101 and a second module 102 rotatably coupled to the first module 101 by a rotational engagement 103. In this embodiment, the rotational engagement is arranged to allow the first and second modules to rotate about an axis that is adjacent and parallel to a first bottom edge of the first module 101. The first bottom edge is adjacent to and parallel with a ground upon which the first module 101 is placed. It is appreciated that the first bottom edge could be any one of the four bottom edges of the first module 101. The first module 101 is arranged to be hooded by the second module 102 when the modular structure 100 is in a hooded position, and unhooded by the second module 102 such that the modular structure 100 is configured to be in an open position. To arrive at the open position from the hooded position, the second module 102 is arranged to undergo rotation relative to first module 101. The rotational engagement 103 between the first module 101 and the second module 102 may include a rotation mechanism such as a hinge or the like. It is appreciated that any suitable rotation mechanism may be applied to realize the rotational engagement. Further, in one embodiment, a crane may be used to assist the transition of the modular structure 100 from the hooded position to

the open position when the modular structure is placed on site. The modular structure 100 may be transported to a construction site in hooded position so as to provide an easy transportation. In one embodiment, both the first module 101 and second module 102 may be configured as substantially cuboid, each defining a top, a bottom, four sides and twelve edges.

The floor structure 110 of the first module 101 and the floor structure 120 of the second module 102 are provided as the bottoms of the first module 101 and second module 102, respectively, when the modular structure 100 is in the open position. The top surface of the floor structure 110 defines the interior floor 111 of the first module 101, which is the bottom boundary of the interior space of the first module 101, when the modular structure 100 is in the open position. Similarly, the top surface of the floor structure 120 defines the interior floor 121 of the second module 102, which is the bottom boundary of the interior space of the second module 102, when the modular structure 100 is in the open position. The interior space of a module refers to the free space enclosed within the dimensions of the module excluding the volume of the walls, floors and roofs.

The hooding arrangement and the rotational engagement where the axis is adjacent and parallel to the first bottom edge of the first module may provide that the first module is not fully enclosed within the interior space of the second module such that the dimensions of the first module is not limited to the interior space dimensions of the second module. This may provide more freedom to design the dimensions of each

module for specific scenarios. It is appreciated that the dimensions of the first module 101 may be smaller, larger or substantially the same as the interior space of the second module 102.

Referring to Figure 2C, the first module 101 is unhooded by the second module 102 such that the modular structure 100 is configured to be in the open position, thereby both the first module 101 and second module 102 are on the same floor level.

In a further embodiment, the axis of the rotational engagement 103 that the first module 101 and second module 102 rotate about is also adjacent and parallel to the second bottom edge of the second module 102. The second bottom edge of the second module 102 aligns with the first bottom edge of the first module 101, when the modular structure 100 is in the open position.

In one embodiment, the axis may be adjacent to the interior spaces of the first module 101 and the second module 102, such that the rotational engagement 103 is separated from the interior spaces of both first module 101 and the second module 102.

In a further embodiment, the external dimension of the first module 101 may be configured to be no larger than the interior space of the second module 102 so as to be fully enclosed within the interior space of the second module 102 when the modular structure 100 is in hooded position. The external dimensions of the first module 101 may be configured with substantially the same dimensions as the interior space of the

second module 102, such that the first module is still fully enclosed within the second module when the modular structure is in the hooded position. But, in this sense, with fixed dimensions of the interior space of the second module 102, the external dimensions of the first module 101 may be maximized, thereby maximizing the total living space the modular structure 100 may provide.

Referring to Figure 5A to 5C, the rotational engagement 303 of an embodiment of present invention is shown. The axis of the rotational engagement 303 is placed within the floor structure 320 of the second module and the floor structure 310 and floor structure 320 of the first and second modules may be of the same thickness, thereby the rotational engagement 303 is below the interior floor 311 and interior floor 321 of the first and second modules and is separated from the interior spaces of the first and second modules. It is appreciated that the thickness of the floor structures may vary for specific scenarios.

The floor structure 320 of the second module is in a substantially vertical position whilst the floor structure 310 of the first module is in a substantially horizontal position, when the modular structure 300 is in hooded position, as shown in Figure 5A. The floor structure 320 of the second module rotates relative to the floor structure 310 of the first module about the axis of the rotational engagement 303, when the modular structure 300 is transitioning from the hooded position to the open position, as shown in Figure 5B. When the modular structure 300 reaches the open position, as shown in Figure 5C, the interior floor 311 of the first module is flush with the interior floor 321 of the second

module. Accordingly, the interior living spaces of first and second module may be smoothly connected as the floors of the first and second modules flush with each other at the same level, providing a large and continuous living space. As a further embodiment, by shifting the axis of the rotational engagement up or down, a split level arrangement between the interior floors 311, 321 of the modules may be achieved. It will be appreciated that to maintain this arrangement, the foundation upon which the second module rests must be prepared to receive the higher or lower second module.

Referring to Figure 1 to 4, in a further embodiment of the present invention, the second module 102 may be arranged to be of the same dimensions as a standard shipping container.

Referring to Figure 1 and Figure 4, in yet another embodiment, the second module may be further provided with a roof to complete the construction of the the second module, when the modular structure is in open position. In one embodiment, the roof may be sized such that its four sides are flush with the sides of the second module and the outer top surface of the roof is flush with the outer top surface of the first module. Alternatively, said roof may be sized to create eaves, having an overhand passed the edges of the second module.

Referring to Figure 6, this shows a derived modular structure according to one embodiment of the present invention having two modular structures positioned oppositely adjacent to each other. When both modular structures 1000, 2000 are in the

open position, the first module 1001 of the modular structure 1000 is adjacent with the first module 2001 of the modular structure 2000. At the same time, the second module 1002 of the modular structure 1000 and the second module 2002 of the modular structure 2000 is rotated out at the opposite ends of the derived modular structure defining a four module assembly at the same level. In one embodiment, the interior floors of the four modules may be flush with each other. In this case, the derived modular structure may provide a double-spaced living unit compared to the living unit formed by one modular structure. The derived modular structure may be transported from the factory to the construction site with its two modular structures bound together. It is appreciated that any suitable binding engagement may be applied, such as chains. It is further appreciated that more than two modular structures may be positioned together in different arrangements such as stacking vertically on top of or positioned adjacent to each other or their combinations to form the derived modular structure so as to meet different living space requirements.

Figure 7 shows a building structure with four storeys formed from a plurality of modular structures by stacking them vertically on top of and positioning them adjacent to each other. It is appreciated that a building structure with less or more than four storeys and each storey with more than two modular structures, may also be achieved according to a further embodiment of present invention.

It is to be understood that the embodiments and features described above should be considered exemplary and not restrictive. Many other embodiments will be apparent to

those skilled in the art from consideration of the specification and practice of the invention. Furthermore, certain terminology has been used for the purposes of descriptive clarity, and not to limit the disclosed embodiments of the invention.

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Claims

1. A modular structure, comprising:

a first module;

a second module, said first and second modules rotatably coupled to each other by a rotational engagement;

said first module is arranged to be hooded within the second module when the modular structure is in a hooded position;

said first and second modules are arranged to rotate relative to each other from the hooded position to an open position;

wherein the rotational engagement is arranged to allow the first and second modules to rotate about an axis that is adjacent and parallel to a first bottom edge of the first module; and

said first bottom edge is adjacent to and parallel with a ground upon which the first module is placed.

2. The modular structure according to claim 1, wherein the first module is unhooded by the second module such that the modular structure is configured to be in the open position.

3. The modular structure according to any one of the preceding claims, wherein the axis is adjacent and parallel to a second bottom edge of the second module, said

second bottom edge aligns with the first bottom edge, when the modular structure is in the open position.

4. The modular structure according to any one of the preceding claims, wherein the axis is adjacent to an interior space of the first module.

5. The modular structure according to any one of the preceding claims, wherein the axis is adjacent to an interior space of the second module.

6. The modular structure according to claim 5, wherein the first module is arranged to be fully enclosed within the interior space of the second module when the modular structure is in the hooded position.

7. The modular structure according to any one of the preceding claims, wherein an interior floor of the first module is flush with an interior floor of the second module, when the modular structure is in the open position.

8. The modular structure according to any one of the preceding claims, wherein the second module is arranged to be of the same dimensions as a standard shipping container.

9. A building structure, comprising:

a plurality of modular structures according to any one of claims 1 to 8, said modular structure arranged to be adjacent to each other; and

wherein at least one edge of one modular structure is aligned with a corresponding edge of the adjacent modular structure.

10. The building structure according to claim 9, wherein at least one modular structure is arranged to be stacked vertically on top of another modular structure.

11. A method for installing a modular structure according to any one of claims 1 to 8, comprising the steps of:

rotating the second module about the axis to unhood the first module so as to transit the modular structure from the hooded position to the open position.

12. The method installing a modular structure according to claim 11, further comprising the step of positioning the modular structure adjacently to another modular structure.