

Description

Title of Invention: CONCRETE HOLLOW MODULES FOR A WALL OR ROOM CONSTRUCTION

Technical Field

- [1] The present invention relates generally to concrete hollow modules for a wall or room construction. Interlocking of adjacent concrete hollow modules, with surface-to-surface and end-to-end tongue and groove mechanisms, is achieved by staggered courses of said modules disposed one on top of another and end to end in parallel or orthogonal orientation of construction. Particularly, the present invention relates to one preferred embodiment of concrete hollow modules to construct a straight wall in parallel orientation, preferably with staggering, and to construct wall or room negotiating L-shaped corners, T-junctions or cross junctions in orthogonal orientation with staggering.

Background Art

- [2] In wall or room construction, bricks or blocks usually are laid on their flat sides to form courses (horizontal layers). Bricks or blocks are staggered so that they lap over each other. Thus, it is possible to distribute loads over a large area. Mortar, 3 to 13 mm thick, is disposed between bricks or blocks to form vertical and horizontal joints. The mortar secures an even bearing, holds the bricks or blocks in position, and makes a tight wall or room.
- [3] The length, width and height of a brick are typically 215 mm, 102.5 mm and 65 mm, respectively. Because of these dimensions, bricks are conveniently used to constitute L-shaped corners, T-junctions or cross junctions during wall or room construction.
- [4] The main disadvantage of brickwork is that bricks are comparatively small-sized and requires the skills of a bricklayer. Construction of brickwork is slow, time-consuming and becomes expensive.
- [5] The length, width and height of a clay block are typically 300 mm, 62.5 mm to 150 mm, and 215 mm, respectively.
- [6] The length, width and height of a concrete block are typically 390 mm to 590 mm, 60 mm to 215 mm, and 90 mm to 215 mm, respectively.
- [7] With an increase in the length of the blocks, the speed of on-site construction is improved.
- [8] In an earlier Malaysian Patent Number MY-128946-A, the inventors disclosed a construction method employing precast concrete hollow modules, comprising elongated modules and connector modules. These modules can be easily handled manually or mechanically. Each elongated module takes the form of an elongated hollow block. A wall is thus constructed by stacking a plurality of said elongated modules on top of one

another. Four walls of an enclosure such as a room are then constructed by stacking correspondingly precast concrete hollow T- or L-shaped or cross connector modules which adjoin said walls.

- [9] The main disadvantage of this earlier Malaysian patent is that different moulds are required to manufacture the elongated modules, T-shaped connector modules, L-shaped connector modules and cross connector modules. This invariably increases the cost and time of wall or room construction.

Summary of the Invention

- [10] The present invention has therefore as a primary object to use one preferred embodiment of concrete hollow modules to construct a straight wall in parallel orientation, preferably with staggering, and to construct a wall or room negotiating L-shaped corners, T-junctions or cross junctions in orthogonal orientation with staggering.
- [11] Another object of the present invention is to reduce the cost of production and construction with this preferred embodiment of concrete hollow modules. Yet, another object of the present invention is to minimize the use of mortar between adjacent concrete hollow modules while interlocking them. Still, another object of the present invention is to incorporate some profiling variations on either one elongated side face or both elongated side faces of concrete hollow modules which are used in constructing wall configurations.
- [12] These objects are achieved by providing one preferred embodiment of a concrete hollow module without or with profiling variation. The basic module assumes essentially the shape of a block, preferably rectangular in shape. Said concrete hollow module is provided with a plurality of cavities in its body, and a plurality of sets, including two terminal sets and one intermediate set, of two parallel raised ridges disposed on opposite elongated sides at the top surface of the concrete hollow module along its length. A groove depression is disposed at the bottom surface of said concrete hollow module that could engage a chosen set of raised ridges in a parallel orientation as well as in an orthogonal orientation. The integrity of L-shaped corners, T-junctions or cross-junctions in orthogonal orientation is enhanced by the interlocking effect formed by staggered courses of concrete hollow modules.
- [13] Consequently, a wall or room construction, using staggered courses of concrete hollow modules of this preferred embodiment comprises the steps of:-
- [14] forming a first course of said concrete hollow modules each with a plurality of vertically disposed cavities in its body, and a plurality of sets, including two terminal sets and one intermediate set, of two parallel raised ridges on opposite elongated sides of each concrete hollow module along its length;
- [15] positioning next adjacent course of said concrete hollow modules over the first or previous course in parallel or orthogonal orientation;

- [16] filling any gap in one course with a cut-off section of said concrete hollow module, cut by sawing;
- [17] stacking these courses with staggering to match the desired height of a wall; and
- [18] staggering these courses to negotiate L-shaped corners, T-junctions or cross junctions in orthogonal orientation wherein next adjacent hollow module is disposed orthogonally on top of a chosen set of raised ridges of concrete hollow module from the first or previous course;
- [19] whereby the interlocking effect between the staggered courses is achieved by a first surface-to-surface interlocking tongue and groove mechanism and a second end-to-end interlocking tongue and groove mechanism between said concrete hollow modules.
- [20] Concrete hollow modules without or with profiling variations are stacked to form walls, for low-rise houses, resort units, log cabins, retreat houses, staff quarters in remote area, temporary offices, guard houses, hawker stalls, fencing and the like.

Brief Description of the Drawings

- [21] In order that the present invention may be more readily understood, the following description is given, by way of example, of one preferred embodiment of a concrete hollow module, without or with some profiling variations, for a wall or room construction.
- [22] Reference will be made to the accompanying drawings, in which:-
- [23] Figure 1a is a perspective view of one preferred embodiment of a concrete hollow module in accordance with the present invention, with two parallel vertical groove lines provided at each end of the concrete hollow module.
- [24] Figure 1b is a top view of the concrete hollow module as shown in Figure 1a.
- [25] Figure 1c is a side view of the concrete hollow module as shown in Figure 1a.
- [26] Figure 1d is one end view of the concrete hollow module as shown in Figure 1a.
- [27] Figure 1e illustrates an end view of three concrete hollow modules stacked one on top of another.
- [28] Figure 1f is a perspective view of the preferred embodiment as shown in Figure 1a where the wall section in between the two parallel vertical groove lines is being knocked off.
- [29] Figure 2 is a perspective view of an L-shaped corner constituted by stacking courses of the concrete hollow modules in a staggered manner.
- [30] Figure 3 is a perspective view of a T-junction constituted by stacking courses of the concrete hollow modules in a staggered manner.
- [31] Figure 4 is a perspective view of a cross junction constituted by stacking courses of the concrete hollow modules in a staggered manner.
- [32] Figure 5a is a top view of one course of the concrete hollow modules.
- [33] Figure 5b is a top view of another course of the concrete hollow modules adjacent to the course in Figure 5a.

- [34] Figure 6 illustrates a perspective view of an L-shaped corner of a room fitted with a door frame and a window frame, formed by staggered courses of the concrete hollow modules.
- [35] Figure 7a is a wall constructed from courses of concrete hollow modules without and with first profiling variation.
- [36] Figure 7b is an end view of the wall as shown in Figure 7a.
- [37] Figure 8a is a wall constructed from courses of concrete hollow modules with second profiling variation.
- [38] Figure 8b is an end view of the wall as shown in Figure 8a.
- [39] Figure 9a is a wall constructed from courses of concrete hollow modules with third profiling variation.
- [40] Figure 9b is a top view of the wall as shown in Figure 9a.

Disclosure of Invention

Detailed Description of the Invention

- [41] A preferred embodiment of concrete hollow modules (10) as a basic building module, with some profiling variations, is disclosed according to the present invention.
- [42] To facilitate explanation, same numerals are used for common components or elements. To distinguish common components or elements, superscript symbol ' or " and suffix "x", "a", "b" or "c" are added to the same numerals.
- [43] Further, a wall or room construction uses concrete hollow modules (10) with some profiling variations (10a, 10b, 10c) to form staggered courses to match the desired height of a wall or room.
- [44] In this description, the term "tongue and groove mechanism" is used generally and should be understood as widely as technically known. For an instance, a "tongue" is essentially a protrusion which can be a protruded surface or a raised ridge. Similarly, a "groove" is essentially a reception to the "tongue", which can be a groove depression or a depressed surface. The tongue and groove mechanism serves as an inter-locking mechanism. An end-to-end interlocking tongue and groove mechanism means that a tongue is disposed on one end of a concrete hollow module (10') to cooperate correspondingly with a groove disposed on one end of adjacent concrete hollow module (10").
- [45] Figures 1a, 1b, 1c and 1d show a preferred embodiment of a concrete hollow module (10) in accordance with the present invention. This is the basic building module for the wall or room construction. The concrete hollow module (10) assumes essentially the shape of a rectangular block.
- [46] The body of the concrete hollow module (10) includes a plurality of vertically disposed cavities (13). Each vertically disposed cavity (13) has its vertical axis in its opening parallel to the plane of its side surface. Both the length and the width of the concrete hollow module (10) play a part in determining the number of vertically

disposed cavities (13) and also the size of the vertically disposed cavities (13). In other profiling variations, at least one elongated side face of each concrete hollow module (10) can be inclined or ridged.

- [47] To facilitate explanation, five vertically disposed cavities (13) are shown in the drawings. Three vertically disposed cavities (13) are suitably rounded, preferably oval-shaped, whereas two terminal vertically disposed cavities (13') are substantially truncated towards the end of the concrete hollow module (10). It is important to note that other rounded shapes of the cavities are possible. The rounded shape of the cavity is to prevent crack lines from appearing at the corner of the vertically disposed cavity (13).
- [48] As in prior art, these vertically disposed cavities (13) in the concrete hollow module (10) are useful for some other functions which will not be elaborated in this specification. For an example, these vertically disposed cavities (13) can be filled with filler material and reinforcement to form columns and beams by placing bars where needed. These vertically disposed cavities (13) are also used for concealed piping and wiring.
- [49] On one hand, a plurality of sets, including two terminal sets and one intermediate set, of two substantially parallel raised ridges (14) are integrally disposed on opposite elongated sides at the top surface of the concrete hollow module (10) along its length. Terminal sets are disposed towards the ends of the concrete hollow module whereas the intermediate set is disposed in between the terminal sets along the length of the concrete hollow module. In Figures 1a, 1b and 1f, five vertically disposed cavities (13, 13') correspond with five sets of two substantially parallel raised ridges (14). However, it is also important to note that two entitles, i.e. cavities (13) and raised ridges (14), are separate from each other and there is strictly no connection between the two entitles.
- [50] Each set of two raised ridges (14) can be considered as "tongues" in a first surface-to-surface tongue and groove mechanism. The bottom surface of a concrete hollow module (10) is correspondingly profiled in the shape of a groove depression (15) to engage a chosen set of the raised ridges (14). The raised ridges (14') on one concrete hollow module (10') and the groove depression (15'') on adjacent concrete hollow modules (10'') disposed on top cooperate correspondingly to form the first interlocking tongue and groove mechanism as shown in Figure 1e.
- [51] The first interlocking tongue and groove mechanism takes place at the surface-to-surface sections of two concrete hollow modules (10', 10'') disposed one on top of another. It is also important to note that the first surface-to-surface interlocking tongue and groove mechanism includes a space for reinforcing bars, cables and conduits.
- [52] On the other hand, one end of the concrete hollow module (10) includes a protruded surface (11), whereas the other end includes a depressed surface (12). As seen in Figure 2, the protruded surface (11') on one concrete hollow module (10') would cooperate correspondingly with the depressed surface (12'') on one end of adjacent

concrete hollow module (10") to form a second interlocking tongue and groove mechanism. The second interlocking tongue and groove mechanism takes place at the end-to-end sections of adjacent concrete hollow modules (10', 10").

- [53] The two interlocking tongue and groove mechanisms allow courses of adjacent concrete hollow modules (10', 10") disposed one on top of another and end to end, to self-align during a wall or room construction, thus reducing the need for skilled workers. As seen in Figure 1e, these interlocking tongue and groove mechanisms provide a good guidance to courses of concrete hollow modules (10', 10") when forming a wall.
- [54] The length of the concrete hollow module (10) can be varied during production by changing the length of the mould. For one instance, in a dry cast method of production, the weight of the concrete hollow module (10), at 750 mm length, is approximately 26 kg. A suitable weight for a worker to carry should not exceed 30 kg. The strength of the concrete hollow module (10) will be reduced if it is made longer. This increased length will result in more breakages during handling and transportation. The length of the concrete hollow module (10) is also constrained by the block machine. Concrete hollow modules (10) with longer length will face difficulty in achieving even pressure across the mould. This will result in uneven distribution of cement and appearance of weak spots. Thus, 750 mm is the optimum length, all things considered. Alternatively, for another instance, a wet cast method of production does not have such weight or length constraint.
- [55] The concrete hollow module (10) is also provided with two parallel vertical groove lines (16) on each end as shown in Figure 1a. These parallel vertical groove lines (16) are provided to facilitate on-site knocking using a hammer during construction. Figure 1f shows the concrete hollow module where the wall section in between the two parallel vertical groove lines (16) has been knocked off. The knocking off of the wall section is done when the concrete hollow modules (10', 10") are joined together to form beams by adding steel bars and filling concrete into the vertically disposed cavities (13).
- [56] According to the present invention, there can be a parallel orientation or an orthogonal orientation of stacking courses. In a parallel orientation, a straight wall is constructed. In an orthogonal orientation, an L-shaped corner, a T-junction or a cross junction is constructed. A first course of the concrete hollow modules (10') is laid. A second or next adjacent course of the concrete hollow modules (10") is laid in parallel or orthogonal orientation on the first or previous course. Courses are thus stacked to build up the desired height. The wall is load-bearing.
- [57] Consequently, a wall or room construction, using staggered courses of concrete hollow modules (10) of this preferred embodiment comprises the steps of:-

- [58] forming a first course of said concrete hollow modules (10'), each with a plurality of vertically disposed cavities (13) in its body, and a plurality of sets, including two terminal sets and one intermediate set, of two parallel raised ridges (14), with gaps in between, on opposite elongated sides at the top surface of the hollow concrete module (10) along its length;
- [59] positioning next adjacent course of said concrete hollow modules (10'') over the first or previous course in parallel or orthogonal orientation;
- [60] filling any gap in one course with a cut-off section (10x) of said concrete hollow module (10), cut by sawing;
- [61] stacking these courses to build up the desired height of a wall; and
- [62] staggering these courses to negotiate L-shaped corners, T-junctions or cross junctions in orthogonal orientation wherein next adjacent hollow module is disposed orthogonally on top of a chosen set of raised ridges (14) of a concrete hollow module from the previous course;
- [63] whereby the interlocking effect between the staggered courses is achieved by a first surface-to-surface interlocking tongue and groove mechanism and a second end-to-end interlocking tongue and groove mechanism between said concrete hollow modules (10', 10'').
- [64] Further, in accordance with the present invention, concrete hollow modules (10) can be transported and handled easily. They would require less hassle on site with dry construction method. Concrete hollow modules without or with profiling variations (10, 10a, 10b, 10c) are ideally stacked to form walls, for low-rise houses, resort units, log cabins, retreat houses, staff quarters in remote area, temporary offices, guard houses, hawker stalls, fencing and the like.
- [65] In Figure 2, an L-shaped corner is constituted by stacking two walls of staggered courses of concrete hollow modules (10). Any gap in one course due to this staggered stacking can be filled up by a cut-off section (10x) of the concrete hollow module (10), where it is cut by sawing. The integrity of L-shaped corners is enhanced by the interlocking effect formed by staggered courses of concrete hollow modules. In a first or previous course, the terminal set of a first concrete hollow module is disposed orthogonally next to the terminal set of a second concrete hollow module. Concrete hollow module from next adjacent course is staggered orthogonally over the first and the second concrete hollow module from the first or previous course, while negotiating L-shaped corner during wall or room construction.
- [66] In Figure 3, a T-junction is constituted by stacking two staggered courses of concrete hollow modules (10). Any gap in one course due to this staggered stacking can also be filled up by a cut-off section (10x) of the concrete hollow module (10), where it is cut by sawing. The integrity of T-junction is enhanced by the interlocking effect formed by staggered courses of concrete hollow modules. In a first or previous course, the

terminal set of a third concrete hollow module is disposed orthogonally next to the intermediate set of a fourth concrete hollow module. Concrete hollow module from next adjacent course is staggered orthogonally over the third and the fourth concrete hollow module from the first or previous course, while negotiating T junction during wall or room construction.

- [67] In Figure 4, a cross junction is constituted by stacking two walls of staggered courses of concrete hollow modules (10). Any gap in one course due to this staggered stacking can also be filled up by a cut-off section (10x) of the concrete hollow module (10), where it is cut by sawing. The integrity of cross-junctions is enhanced by the interlocking effect formed by staggered courses of concrete hollow modules. In a first or previous course, terminal sets of a fifth and a sixth concrete hollow module are disposed orthogonally next to the intermediate set of a seventh concrete hollow module. Concrete hollow module from next adjacent course is disposed orthogonally over the terminal sets of the fifth and the sixth concrete hollow modules and the intermediate set of the seventh concrete hollow module from the first or previous course, while negotiating a cross junction during wall or room construction.
- [68] Figures 5a and 5b illustrate respectively particular orientation of two adjacent courses of concrete hollow modules (10', 10''), disposed one on top of another, of wall construction. Any gap in one course due to this staggered stacking can also be filled up by a cut-off section (10x) of the concrete hollow module (10), where it is cut by sawing. Workers will require training on how to lay and stagger these concrete hollow modules (10', 10'').
- [69] In Figure 6, an L-shaped corner of a room is fitted with a door frame and a window frame, courses of concrete hollow modules (10) are stacked in a staggered manner.
- [70] In the above description, the concrete hollow module (10) has been explained as a basic building module. It is important to note that concrete hollow modules of other profiling variations are possible.
- [71] In Figures 7a and 7b, the concrete hollow modules (10, 10a) without and with profiling variation on one elongated side face are shown to be stacked without stagger in one preferred wall configuration.
- [72] In Figures 8a, 8b, 9a and 9b, the concrete hollow modules (10b, 10c) with profiling variations on one elongated side face are shown to be stacked without stagger in preferred wall configurations.
- [73] In Figures 7a and 7b, concrete hollow module (10a) of a first profiling variation is illustrated by varying the width of the concrete hollow module (10) on one elongated side face. The wall surfaces on these elongated side faces become staggered due to different widths. A preferred wall configuration is thus constructed using the concrete hollow modules (10, 10a) of different widths at alternate course. The other elongated

side faces of each course of the concrete hollow modules (10, 10a) remain aligned, so that a flush wall surface is achieved.

[74] In Figures 8a and 8b, concrete hollow module (10b) of a second profiling variation lies in inclining one elongated side face of the concrete hollow module. The wall surfaces on these elongated side faces become undulating due to the inclined faces of each course. A preferred wall configuration is thus constructed, where the other elongated side faces of each course of the concrete hollow modules (10b) remain aligned, so that a flush wall surface is achieved.

[75] In Figures 9a and 9b, concrete hollow module (10c) of a third profiling variation lies in ridging one elongated side face of the concrete hollow module. The wall surfaces on these elongated side faces become ridged due to the ridges on the face of each course. A preferred wall configuration is thus constructed, where the other elongated side faces of each course of the concrete hollow modules (10c) remain aligned, so that a flush wall surface is achieved.

[76] In the above preferred wall configurations, profiling variations are disposed on one elongated side faces of the concrete hollow modules (10), whereas the other elongated side faces of the concrete hollow modules (10) are essentially flush with adjacent concrete hollow modules (10, 10a, 10b, 10c). It is important to note that profiling variations can be disposed on both elongated side faces of the concrete hollow modules (10) which are used to construct other wall configurations.

Claims

- [Claim 1] Concrete hollow modules, for wall or room construction built from staggered courses of the same, is characterized in which each concrete hollow module (10) assumes essentially the shape of a block, preferably rectangular, with a plurality of vertically disposed cavities (13) in its body, each cavity (13) with a vertical axis in its opening parallel to the plane of its side surface; a plurality of sets, including two terminal sets and one intermediate set, of two substantially parallel raised ridges (14) are integrally disposed on opposite elongated sides at the top surface of the concrete hollow module (10), whereas the bottom surface of the concrete hollow module (10) is correspondingly profiled in the shape of a groove depression (15) to engage the raised ridges (14), the raised ridges (14) are intermittent with gaps in between them; each end of the concrete hollow module (10) includes a protruded surface (11), whereas the other end includes a depressed surface (12); whereby only one preferred embodiment of concrete hollow modules (10) is used for wall or room construction; whereby one set of two substantially parallel raised ridges (14') on one concrete hollow module (10') from a first or previous course cooperate correspondingly with a groove depression (15'') on adjacent concrete hollow module (10'') from next adjacent course to constitute a first surface-to-surface interlocking tongue and groove mechanism; and whereby the protruded surface (11') on one concrete hollow module (10') would cooperate correspondingly with the depressed surface (12'') on adjacent concrete hollow module (10'') disposed end to end to constitute a second interlocking tongue and groove mechanism; whereby concrete hollow module from next adjacent course is disposed on top of concrete hollow module from the first or previous course in parallel orientation, preferably with staggering, to form a straight wall; whereby concrete hollow module from next adjacent course is disposed orthogonally on top of a chosen set of raised ridges (14) of at least one concrete hollow module from the first or previous course with staggering, while negotiating L-shaped corner, T-junction or cross junction in orthogonal orientation during wall or room construction.
- [Claim 2] Concrete hollow modules (10) of Claim 1 in which the first surface-to-surface interlocking tongue and groove mechanism includes a space for reinforcing bars, cables and conduits.

- [Claim 3] Concrete hollow modules (10) of Claim 1 in which the openings of the vertically disposed cavities (13) are suitably rounded, preferably oval-shaped.
- [Claim 4] Concrete hollow modules (10) of Claim 1 in which profiling variation can be disposed on one elongated side faces of the concrete hollow modules (10) while the other elongated side faces of each course of the concrete hollow modules (10, 10a, 10b, 10c) remain aligned, so that a flush wall surface is achieved when a preferred wall configuration is constructed.
- [Claim 5] Concrete hollow modules (10) of Claim 1 in which profiling variation can be disposed on both elongated side faces of the concrete hollow modules (10) which are used to construct a wall configuration.
- [Claim 6] Concrete hollow modules (10) of Claim 1 in which two parallel vertical groove lines (16) are provided on each end of the concrete hollow module (10), whereby the wall section in between the two parallel vertical groove lines (16) can be knocked off.
- [Claim 7] Concrete hollow modules (10) of Claim 1 in which the terminal set of a first concrete hollow module is disposed orthogonally next to the terminal set of a second concrete hollow module from the first or previous course;
concrete hollow module from next adjacent course is staggered orthogonally over the first and the second concrete hollow module from the first or previous course, while negotiating L-shaped corner during wall or room construction.
- [Claim 8] Concrete hollow modules (10) of Claim 1 in which the terminal set of a third concrete hollow module is disposed orthogonally next to the intermediate set of a fourth concrete hollow module from the first or previous course;
concrete hollow module from next adjacent course is staggered orthogonally over the third and the fourth concrete hollow module from the first or previous course, while negotiating T junction during wall or room construction.
- [Claim 9] Concrete hollow modules (10) of Claim 1 in which the terminal sets of a fifth and a sixth concrete hollow module are disposed orthogonally next to the intermediate set of a seventh concrete hollow module from the first or previous course;
concrete hollow module from next adjacent course is disposed orthogonally over the terminal sets of the fifth and the sixth concrete hollow modules and the intermediate set of a seventh concrete hollow

module from the first or previous course, while negotiating a cross junction during wall or room construction.

[Claim 10] Concrete hollow modules (10) of Claim 1 in which the weight of a concrete hollow module (10) is not more than 30 kg, in a dry cast method of production.

[Claim 11] Concrete hollow modules (10) of Claim 1 in which the length of a concrete hollow module (10) is not more than 750 mm, in a dry cast method of production.

[Claim 12] Concrete hollow modules (10) of Claim 1 in which said concrete hollow modules (10) are made in a wet cast method of production.