

PATENT SPECIFICATION

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(54) DEMOUNTABLE BUILDINGS

(71) We, MELOCCO BROS. PTY. LIMITED, of 1 Booth Street, Annandale, N.S.W. Australia, a Company incorporated under the laws of the State of New South Wales, Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to demountable buildings assembled from constructional units, hereinafter referred to as building modules, from which buildings may be formed and to reinforced concrete building modules in particular. the invention also relates to buildings formed substantially by building modules and to a method of constructing such buildings.

The present high cost of buildings in general and of houses in particular is, in large part, due to the present materials and methods used in their construction. The need to be able to construct a wide variety of different types and sizes of buildings has hindered the development of preformed and prefabricated structures which have universal application. Thus, the use of fundamental building components such as individual bricks and pieces of timber has been continued, thereby precluding the realisation of any of the cost advantages to be gained through mass production and maintaining the cost of labour as a high percentage of total building costs.

The abovementioned cost of buildings may be reduced according to the present invention by a demountable building assembled from a juxtaposed plurality of pre-formed open-ended tubular building modules of substantially rectangular cross-section made from pre-cast reinforced concrete, each said module being formed from four sides having substantially equal axial lengths wherein the two opposite sides having the greater transverse dimension are spaced apart to form at least part of the ceiling and floor of a room in said building and the other opposite sides form at least

part of the walls of said room or building, each said module having two spaced, transversely extending circumferential, outwardly projecting integral ribs of substantially rectangular cross-section parallel to the open ends of said module sloely supporting said opposite sides of the module having greater transverse dimension, and said modules being removably positioned adjacent each other in one or more layers to form said building with the ribs of each module abutting at least one other module along a portion thereof and the sides of said modules being spaced from each other by said ribs to define horizontally and vertically extending cavities throughout the building free of any hardened initially flowable material forming an additional load bearing structure whereby the load of any roof or upper layer(s) is substantially supported by the ribs of the modules of the single layer or lower layers respectively without the need for such an additional load bearing structure.

One preferred embodiment of the invention, having additional advantages as will become apparent, will now be described with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a building module made from reinforced concrete,

Fig. 2 is a cross-section of the module shown in Fig. 1,

Fig. 3 is an elevation of the module shown in Fig. 1, a portion of the module being removed to show the internal reinforcing,

Fig. 4 is an end view of four modules arranged to form a two storeyed building,

Fig. 5 is a perspective view of a portion of Fig. 4,

Fig. 6 is an end view of seven modules arranged to form a three storeyed building,

Fig. 7 is an elevation of a completed two storey building using eight modules, and

Fig. 8 is a plan of the building shown in Fig. 7.

Referring now to Figs. 1 to 3, the module

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1 of the preferred embodiment is formed from reinforced concrete and comprises an open ended four sided tube of substantially rectangular cross-section. The sides having the longer transverse dimension are the floor side 2 and the ceiling side 3, and are spaced apart by two wall sides 4. The height of the wall sides 4 is such that the module conveniently defines a volume suitable for a room or part of a room. Two ribs 5 extend circumferentially around the module 1 and project outwardly from the outer surface of the sides of the module 1. The ribs 5 are generally rectangular but are tapered slightly, the thickness of the rib 5 decreasing slightly in directions away from the module 1. This taper on the rib 5 is provided to facilitate the removal of the module 1 from the mould in which it is cast. The ribs 5 have a plurality of openings 6 therein which extend right through the ribs 5.

The wall sides 4 each have an aperture 7 therein which extends between the floor side 2 and the ceiling side 3. The apertures 7 are longitudinally centrally located in the module 1 and the ribs 5 pass one to either side of the apertures 7.

Figures 2 and 3 show the internal steel reinforcing 8 contained within the module 1. It is to be understood that the particular configuration of the steel reinforcing 8 is in no way limiting as many different and varied arrangements could be used.

It is preferable that the transverse width and the longitudinal length of the module 1 are integrally related. This enables the modules to be placed together so that adjacent modules abut each other along a portion of, or the entire length of, the open end of each module. Alternatively or simultaneously adjacent modules may abut along one wall side of the adjacent modules. Other combinations will also be apparent to those skilled in the art.

Figure 4 shows four modules 10 to 13 arranged together to form a two storeyed structure. In this arrangement the modules 10 and 11 of the upper storey are placed directly above the modules 12 and 13 of the lower storey with the ribs 5 of modules 10 and 11 aligned with the ribs 5 of modules 12 and 13 respectively. The modules are retained in position by means of H members 9 which receive the edges of the ribs 5. Fig. 5 shows one H member 9 in more detail. Four H members 9 are used to space and position the modules 10 and 13 in order that the weight of module 10 be located above the wall sides of module 13.

Figure 6 shows an alternative form of arranging the modules to provide a multi-storeyed building. Here succeeding layers of modules are slightly misaligned in order that corresponding pairs of ribs 5 of

vertically adjacent modules abut each other. In addition, the ribs 5, of the uppermost layer formed from modules 14 and 15, abut the ceiling sides 3 of the modules 16 to 18 which form the middle layer. The ribs 5 of modules 19 and 20, which form the lowermost layer, abut the floor sides 2 of the modules 16 to 18. The ribs 5 of module 17 abut the floor side 2 of modules 14 and 15 and the ceiling side 3 of modules 19 and 20. Only one rib 5 of each of modules 16 and 18 abuts the floor or ceiling side of a vertically adlacent module as modules 16 and 18 protrude past the other modules and thereby provide an upper level balcony structure.

In Fig. 6 the modules may be secured together by means of tie bolts (not shown) which pass through openings 6 in the ribs 5.

It will be seen from Figs. 4 and 6 that when the modules are placed together the ribs 5 create ducts 29 within the structure which may be used for the provision of services, such as electrical wiring, plumbing, thermal and acoustic insulation and the like, within the building.

Figs. 7 and 8 respectively show an elevational and plan view of a two storeyed building structure using the modules of the present invention. The building constructed from eight modules 21 to 28. Modules 21 to 23 are arranged with their longitudinal axes coinciding. Modules 26 to 28 are arranged with their longitudinal axes coinciding and perpendicular to the longitudinal axes of modules 21 to 23. As the modules of the preferred embodiment have a transverse width three times the longitudinal length of the module, the modules may be placed together in the above described fashion without any overlap occurring. Modules 24 and 25 have their longitudinal axes coinciding and parallel to the axes of modules 21 to 23.

the apertures 7 (Fig. 1) in the modules 21 to 28 may be utilised to provide openings for windows and doors within the building. The area within the modules may be partitioned into rooms as desired, the apertures 7 providing interior doorways and the like. The open end of modules, such as modules 21, 24, 25, 26 and 28, which will form an exterior portion of the building may be enclosed in any convenient manner to provide external windows, doors, and wall surfaces. The modules may be painted or coated with a plastics membrane in order that the structure is completely weatherproof. In addition, if desired, conventional roofs may be added to structures formed from the modules.

The advantages of the present invention include a relatively low unit cost for the module itself; the speed with which a structure may be built using the modules;

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the ability of such a structure to be dismantled, moved to another location, and re-assembled; and the ability for additions and extensions comprising additional modules to be added to pre-existing structures already formed from the modules.

The foregoing describes only one embodiment of the present invention and modifications, obvious to those skilled in the art, may be made thereto without departing from the scope of the present invention. Such modifications would include the provision of only one aperture 7 in the side walls 4 (Fig. 1), the complete absence of any apertures in the side walls 4, and the location of wiring and plumbing services within the actual sides of the module itself.

20 WHAT WE CLAIM IS:—

1. A demountable building assembled from a juxtaposed plurality of pre-formed open-ended tubular building modules of substantially rectangular cross-section made from pre-cast reinforced concrete, each said module being formed from four sides having substantially equal axial lengths wherein the two opposite sides having the greater transverse dimension are spaced apart to form at least part of the ceiling and floor of a room in said building and the other opposite sides form at least part of the walls of said room or building, each said module having two spaced, transversely extending, circumferential, outwardly projecting integral ribs of substantially rectangular cross-section parallel to the open ends of said module solely supporting said opposite sides of the module having the greater transverse dimension, and said modules being removably positioned adjacent each other in one or more layers to form said building with the ribs of each module abutting at least one other module along a portion thereof and the sides of said modules spaced from each other by said ribs to define horizontally and vertically extending cavities throughout the building free of any hardened initially flowable material forming an additional load bearing structure whereby the load of any roof or upper layer(s) is substantially supported by the ribs of the modules of the single layer or lower layers respectively without the need for such an additional load bearing structure.

2. The building as claimed in claim 1 wherein said modules are assembled in a plurality of layers, the ribs of the floor side of each module of the upper layer(s) being aligned with and located immediately above the ribs of the ceiling side of a corresponding module of the adjacent lower layer, said floor and ceiling side ribs having a substantially rectangular cross-section and being spaced apart by two spaced, load distributing H members each having two rib receiving channels and being positioned above a wall side of said corresponding module.

3. The building as claimed in claim 1 wherein said modules are assembled in a plurality of layers, the ribs of the floor sides of the modules of the upper layer(s) abutting and being perpendicular to the ribs of the ceiling sides of the modules of the adjacent lower layer.

4. The building as claimed in claim 1 wherein said modules are assembled in a plurality of layers, and each rib of the floor side of each module of the upper layer(s) is parallel to and mutually abuts one lateral surface thereof with a corresponding rib of the ceiling side of a module of the adjacent lower layer.

5. The building as claimed in claim 4 wherein said ribs have transverse apertures therein and said modules are releasably secured to each other by bolts passing through aligned apertures in each pair of mutually abutting ribs.

6. The building as claimed in any one of the preceding claims wherein said modules have an aperture in each wall side located between said circumferential ribs and extending between said floor side and said ceiling side.

7. A building substantially as hereinbefore described with reference to Figs. 4 to 8 of the accompanying drawings.

8. A building module substantially as herein described with reference to Figs. 1 to 3 of the accompanying drawings.

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the ability of such a structure to be dismantled, moved to another location, and re-assembled; and the ability for additions and extensions comprising additional modules to be added to pre-existing structures already formed from the modules.

The foregoing describes only one embodiment of the present invention and modifications, obvious to those skilled in the art, may be made thereto without departing from the scope of the present invention. Such modifications would include the provision of only one aperture 7 in the side walls 4 (Fig. 1), the complete absence of any apertures in the side walls 4, and the location of wiring and plumbing services within the actual sides of the module itself.

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