A transportable building module includes a first structure for defining a first enclosed space when erected at a building site and at least one elongate structural component having at least two elements that are relatively linearly slideable for linearly extending the structural component. The structural component is part of or attached to the first structure and is upright when the first structure is installed at the building site, whereupon the structural component is linearly extensible to provide part of a second structure for defining a second enclosed space above the first space.
TWO-STORY TRANSPORTABLE BUILDING SYSTEM

FIELD OF INVENTION

[0001] The present invention relates generally to transportable buildings, and in one aspect is especially applicable to transportable buildings that provide a second story once installed at a building site.

BACKGROUND OF THE INVENTION

[0002] It is known to pre-construct houses or other buildings at a base yard and then to transport the buildings by road, either whole or in two or more modules, to an allotment. A transportable building is a very satisfactory means of providing a building in a more remote or difficult location where building expenses on site may be higher than elsewhere.

[0003] A key challenge in the design of transportable buildings is the creation of a variety of pleasing designs within the strict dimensional limits set by road transport authorities. Due to these restrictions, transportable buildings have generally had to be designed with limited ceiling heights and/or low pitched roofs.

[0004] A particular challenge in transportable building design is to provide a second storey. Australian patent application 10702/92 discloses a transportable house with separable lower and upper storey modules but the upper storey must be separately transported, which substantially increases the cost of the house relative to the floor area provided.

[0005] A known compromise, in which the house is only partially pre-constructed, is to provide a steep sloping roof for the upper storey as a pair of sub-frames which hinge down onto the ceiling frame of the lower-storey. This avoids the need to transport an additional module and the roof sub-frames can be pivoted into position on site, but this approach involves a partial loss of the advantage of having a transportable house in the first place in that much of the upper storey must be constructed on site. A similar approach is evident in U.S. Pat. No. 5,209,030, in which a dormer frame structure is collapsible onto the top of a base module, and a roofing structure is provided as a separate element and is secured onto the base module during transport.

[0006] Hinged sub-frames are also disclosed in Australian patents 688461 and 767231.

[0007] It is an object of the invention, at least in one or more embodiments, to provide for a transportable building of a construction that provides a second storey once installed at a building site.

SUMMARY OF INVENTION

[0008] The invention provides, in one aspect, a transportable building module, including:

[0009] a first structure for defining a first enclosed space when erected at a building site;

[0010] at least one elongate structural component having at least two elements that are relatively linearly slideable for linearly extending said structural component;

[0011] wherein said at least one structural component is part of or attached to said first structure and is upright when said first structure is installed at the building site, whereupon said at least one structural component is linearly extensible to provide part of a second structure for defining a second enclosed space above said first space.

[0012] In another aspect of the invention, there is provided a transportable building system, including:

[0013] at least partially erecting a first structure for defining a first enclosed space, and forming, as part of or attached to said first structure, at least one elongate structural component having at least two elements that are relatively linearly slideable for linearly extending said structural component;

[0014] transporting said first structure including said elongate structural component to a building site and there installing said first structure, with said elongate structural component upright; and

[0015] linearly extending said elongate structural component and erecting a second structure, of which said elongate structural component provides part, defining a second enclosed space above said first space.

[0016] Preferably, said two elements are members of respective wall frames for the first and second enclosed spaces. One of the wall frames may be an internal wall of the first structure. The wall frames may include wall panels, or wall panels may be installed after the second structure is erected.

[0017] Preferably, after said structural component is linearly extended, the remainder of the second structure is erected.

[0018] Advantageously, one of the two elements of the elongate structural component is slideable within the other of the two elements, such that when the structural component is in its retracted condition, said one element is telescopically housed within the other element.

[0019] Preferably, there are at least two of said elongate structural components mutually spaced apart.

[0020] Alternatively, the two elements may be adjacent one another and one may be slid over the other.

[0021] Said erecting of the second structure may typically include:

[0022] raising a first wall frame upwardly from within said first structure by linearly extending said at least one structural component, thereby also raising a roof frame for said second enclosed space;

[0023] pivoting downwardly a second wall frame from a retracted position adjacent said roof frame to an extended upper position; and

[0024] installing end wall frames between said first and second wall frames;

[0025] whereby to define said second enclosed space.

[0026] In a third aspect, the invention provides a transportable building system including:

[0027] at least partially erecting a first structure for defining a first enclosed space;
[0028] transporting said first structure to a building site and there installing said first structure;
[0029] erecting a second structure defining a second enclosed space above the first space by;
[0030] raising a first wall frame upwardly from within said first structure by linearly extending said at least one structural component, thereby also raising a roof frame for said second enclosed space;
[0031] pivoting downwardly a second wall frame from a retracted position adjacent said roof frame to an extended upright position; and
[0032] installing end wall frames between said first and second wall frames;
[0033] whereby to define said second enclosed space.

[0034] Advantageously, said roof frame is pivoted upwardly about one side thereof before said second wall frame is pivoted downwardly, to raise the height of the other side of said roof frame.

[0035] Preferably, the raising of the first wall frame includes sliding the first wall frame from within a wall frame of the first structure. Alternatively, the first wall frame may be adjacent a wall frame of the first structure.

[0036] Advantageously, the roof frame is connected to the upper end of the first wall frame by hinge means. The second wall frame may also be connected to the roof frame by hinge means.

[0037] Typically, after said second structure is erected, wall panels are installed onto the wall frames. Alternatively, the wall panels are attached to the wall frames prior to transport.

BRIEF DESCRIPTION OF DRAWINGS

[0038] The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

[0039] FIGS. 1a to 1d are rear, side, front and other side elevational views, respectively, of a fully constructed house erected from a transportable building module according to an embodiment of the present invention;

[0040] FIG. 2 is a sectional side view of the fully constructed building of FIGS. 1a to 1d;

[0041] FIG. 3 is an enlarged more-detailed sectional view of the section marked ‘A’ in FIG. 2;

[0042] FIG. 3a is a perspective view of the elongate structural component of FIG. 3; and

[0043] FIGS. 4a to 4m are sectional highly diagrammatic side views illustrating the sequence of steps in the erection of the building of FIGS. 1 and 2 from the transportable building module.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0044] FIGS. 1a to 1d are architectural-style end and side elevations of a partially two-storey house erected from a transportable building module according to an embodiment of the invention.

[0045] According to conventional practice, the module is partially constructed and erected at a first site, typically a large factory yard where multiple such buildings are under construction, and then transported by low-loader in a partially collapsed/partially erected transport condition to the building site. There the module is positioned on a suitable foundation, and then expanded and erected to form the final structure. The entire building may be formed from a single transportable module, as in this case, or there may be two or more separate modules. The or each module when in its transport condition must be within road-transport dimensional limits as earlier discussed.

[0046] FIGS. 4a to 4m diagrammatically depict the sequence of steps by which a module 12 in its transport condition is expanded and erected to form house 10. Steps 4a to 4f are preliminary to the steps of a preferred embodiment of the building system of the invention. When installed at the building site, module 12 already has outer wall 14a, end walls 14b, floor 14c and a wall 30 collectively forming a structure 14 that defines a first, ground floor, enclosed space 16. A floor extension 32 is lowered (FIG. 4b) from a retracted condition adjacent the wall 30, which serves as an internal wall in the completed structure, to a rest position on the foundation (FIG. 4c). Another wall frame 34, which may be hingedly attached to floor extension 32, is raised to create an external wall of the structure opposite wall 30, as can be seen in FIGS. 4d and 4e. Gable end panels 36, end walls 38 and one or more roof panels 40 are installed to define an annexe to enclosed space 16, as can be seen in FIGS. 4f to 4h. Panels 40 may be stored atop roof panelling 45 discussed below, and thereby transported with the module 12, as indicated by dashed lines in FIG. 4j.

[0047] Internal wall 30 of module 12 includes at least one, and in this case, a pair of elongate structural components 18 having elements 20, 22, 20a, 22a that are relatively linearly slideable for linearly extending the structural component 18. Each structural component 18 is part of the structure 14 and is upright when the structure 14 is installed at the building site. The structural components 18 are linearly extensible to provide part of a second structure 24 for defining a second enclosed space 26 above the first enclosed space 16. The second enclosed space 26 forms part of the second storey.

[0048] For each structural component 18, the respective elements 20, 22, 20a, 22a are square-section steel tubes dimensioned so that tubes 20, 20a are telescopically housed within tubes 22, 22a. Elements 20 and 20a are mutually spaced apart and are joined by cross member 21. Elements 22 and 22a are also mutually spaced apart and are joined by cross member 23. Elements 20, 20a, 22, 22a, are members of respective wall frames 28, 30 for the first and second enclosed spaces 16, 26, and cross members 21, 23 also form part of the wall frames 28, 30. The structural components 18 are linearly extended by lifting wall frame 28 (FIG. 4i). Lifting is typically conducted using a crane, however it could also be accomplished manually.

[0049] In the raised position, each tube 20, 20a extends within tube 22, 22a a distance great enough to give the upper end 42 at least temporary stability. A large bolt 52 is placed through corresponding holes 54, 56 in the tubes 20, 22, to secure the tube 20 in the raised position. It will be appreciated that any other appropriate fixing means may be used at any suitable location, and that other brackets, braces and
the like may be secured in place to fix the raised frame 28 with respect to the wall frame 30.

[0050] The upper edge 42 of the wall frame 28 is attached to an upper roof frame 44 by hinges 46. The upper roof frame 44, which has attached roof paneling 45, is also raised as the wall frame 28 is lifted, as can be seen from FIG. 4j. Once the wall frame 28 is lifted and secured, the upper roof frame 44 is pivoted upwardly, such that the height of the upper roof frame 44 is greater at the edge 48 opposite the upper edge 42 of the wall frame 28, as can be seen in FIG. 4j. This outer edge 48 of the upper roof frame 44 is hingedly attached to a second upper wall frame 50, which is under and adjacent the upper roof frame 44 when in the retracted position. The second upper wall frame 50 is pivoted downwardly to an upright position (FIGS. 4k and 4l) and secured in position an upward extension of ground floor wall 14a. Upper end wall frames are installed between the wall frame 28 and the second upper wall frame 50 to fully define the second enclosed first-floor space 26. Wall panels 52 (FIG. 4m) are then fitted to complete “lock-up” of the first floor. FIGS. 1a to 1d illustrate how the various walls or wall panels mentioned above may include windows or doors typically pre-fitted to module 12 but alternatively added on site.

[0051] It will be appreciated that while the embodiment described above includes linearly extending only one wall frame assembly 28, 30, it is possible that more than one wall frame or sub-frame could be raised from within the ground-floor structure 14.

[0052] It will be understood that the invention disclosed and defined in this specification extends to all alternative combinations of two or more of the individual features mentioned or evident from the text or drawings. All of these different combinations constitute various alternative aspects of the invention.

[0053] Having thus described several aspects of at least one embodiment of this invention, it is to be appreciated various alterations, modifications, and improvements will readily occur to those skilled in the art. Such alterations, modifications, and improvements are intended to be part of this disclosure, and are intended to be within the spirit and scope of the invention. Accordingly, the foregoing description and drawings are by way of example only.

We claim:

1. A transportable building module, including:

a first structure for defining a first enclosed space when erected at a building site;

at least one elongate structural component having at least two elements that are relatively linearly slideable for linearly extending said structural component;

wherein said at least one structural component is part of or attached to said first structure and is upright when said first structure is installed at the building site, whereupon said at least one structural component is linearly extensible to provide part of a second structure for defining a second enclosed space above said first space.

2. A transportable building module according to claim 1, wherein said two elements are members of respective wall frames for the first and second enclosed spaces.

3. A transportable building module according to claim 2, wherein one of the wall frames is an internal wall of the first structure.

4. A transportable building module according to claim 2, wherein the wall frames include wall panels.

5. A transportable building module according to claim 1, wherein the wall frames include wall panels.

6. A transportable building module according to claim 1, wherein one of the two elements of the elongate structural component is slideable within the other of the two elements, such that when the structural component is in its retracted condition, said one element is telescopically housed within the other element.

7. A transportable building module according to claim 2, wherein one of the two elements of the elongate structural component is slideable within the other of the two elements, such that when the structural component is in its retracted condition, said one element is telescopically housed within the other element.

8. A transportable building module according to claim 1, wherein the two elements are adjacent one another and one is slid over the other.

9. A transportable building module according to claim 2, wherein the two elements are adjacent one another and one is slid over the other.

10. A transportable building module according to claim 5, wherein the two elements are adjacent one another and one is slid over the other.

11. A transportable building module according to claim 1, wherein there are at least two of said elongate structural components mutually spaced apart.

12. A transportable building module according to claim 1 wherein said elongate structural component(s) carries an assembly of roof and/or wall members expandable to form a further part of said second structure.

13. A transportable building system, including:

at least partially erecting a first structure for defining a first enclosed space, and forming, as part of or attached to said first structure, at least one elongate structural component having at least two elements that are relatively linearly slideable for linearly extending said structural component;

transporting said first structure including said elongate structural component to a building site and there installing said first structure, with said elongate structural component upright; and

linearly extending said elongate structural component and erecting a second structure, of which said elongate structural component provides part, defining a second enclosed space above said first space.

14. A transportable building system according to claim 13, wherein after said structural component is linearly extended, the remainder of the second structure is erected.

15. A transportable building system according to claim 14, wherein said erecting of the second structure includes:

raising a first wall frame upwardly from within said first structure by linearly extending said at least one structural component, thereby also raising a roof frame for said second enclosed space;

pivoting downwardly a second wall frame from a retracted position adjacent said roof frame to an extended upper position; and
installing end wall frames between said first and second wall frames; whereby to define said second enclosed space.

16. A transportable building system including:

at least partially erecting a first structure for defining a first enclosed space;

transporting said first structure to a building site and there installing said first structure;

erecting a second structure defining a second enclosed space above the first space by:

raising a first wall frame upwardly from within said first structure by linearly extending said at least one structural component, thereby also raising a roof frame for said second enclosed space;

pivoting downwardly a second wall frame from a retracted position adjacent said roof frame to an extended upright position; and

installing end wall frames between said first and second wall frames;

whereby to define said second enclosed space.

17. A transportable building system according to claim 16, wherein said roof frame is pivoted upwardly about one side thereof before said second wall frame is pivoted downwardly, to raise the height of the other side of said roof frame.

18. A transportable building system according to claim 16, wherein the raising of the first wall frame includes sliding the first wall frame from within a wall frame of the first structure.

19. A transportable building system according to claim 16, wherein the raising of first wall frame includes sliding the first wall frame from being adjacent a wall frame of the first structure.

20. A transportable building system according claim 16, wherein the roof frame is connected to the upper end of the first wall frame by hinge means.

21. A transportable building system according to claim 16, wherein the second wall frame is connected to the roof frame by hinge means.

22. A transportable building system according to claim 16, wherein after said second structure is erected, wall panels are installed onto the wall frames.

23. A transportable building system according to claim 16, wherein wall panels are attached to the wall frames prior to transport.