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(54) Title: PREFABRICATED COMPONENT SYSTEM

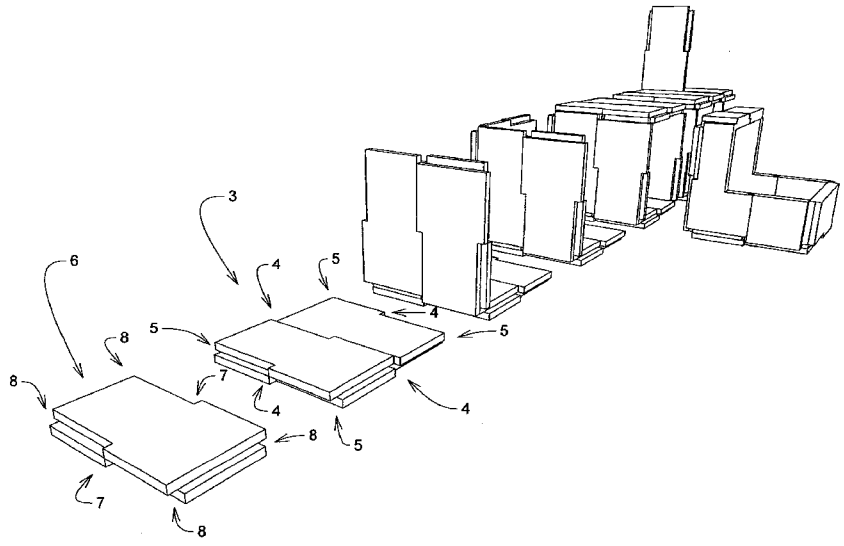



Fig. 2

(57) Abstract: The invention relates to a prefabricated component system for construction using planar component structures of e.g. cubic building parts that can be combined to form small buildings such as sauna baths, summer lodges, guest cabins, grill-, pizza oven shelters etc. The planar component (6, 3) has a rectangular/square shape and the edges of the component have been profiled so that a rightangled onesided rim (1, 2) is formed the width and depth of which equals half the thickness of the component and the rim is formed alternately on the upper and lover part of the component.

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**Prefabricated component system**

This invention relates to a prefabricated component system for construction of e.g. cubical building parts that can be combined to small buildings, such as sauna baths, vacation houses, guest cabins, grill and pizza oven shelters etc.

Previously known solutions

Construction using prefabricated components is per se nothing new. The first prefabricated house can be considered to be the log house technique. Characterizing for them is the need for a great amount of different components and that the number of equal components in use is typically rather small. The same applies to houses built using prefabricated components having e.g. a pole body with or without insulation and covered on one or both side with boards or panels.

Systems based on standardized components have been tried (e.g. the Finnish Domino-houses in the 1970-80:s).

The patent publications US 4,630,418, US 2010/0293885 A1 and WO 02/22975 A1 can be cited as examples of known technology.

Shortcomings of known solutions

A common problem for modular systems is the problem of dimensioning relative to a modular grid. Three different main types can be noted:

If the components lie outside of the modul lines one can, using four equal components, build a square room, the external measures of which is the module + 2 x wall thickness. If one aims to add another room built using the same components this will be transposed from the modular grid and only one of the two corner joints can be joined without adjustment of the length of the component. This has the consequence that many components must be dimensioned so they can only fit in one place. The transposition off the modular grid complicates the design process.

If the components lie within the modular lines two room units can be joined to each other without individual adaptation of the corner parts, but this leads to a doubling of the common wall and thereby to waste of material.

Experiments placing the wall components symmetrically relative to the modul lines have followed two main courses: In the first square or round columns are placed in the intersections of the modular lines so, that the free distance between them equals

the length of the standard component. One drawback of this is e.g. that the heat insulation in the columns is inferior than that of the wall components. According to the second main principle the ends of the wall components is formed like a V where the point touches the crossing point of the modular lines. A drawback of this is that the thickness of the walls (and thus the thickness of the insulation) in the corners is diminished, and also that the joining of diagonal surfaces in the corners demands precision and temporary supporting structures

A common property of all the above mentioned traditional systems is that the prefabricated wall components cannot be used as floor- or ceiling components and vice versa.

Characteristic for the component system according to the invention is that the planar components main form is rectangular/square and that the edges of the components are profiled in such a manner, that a rightangled, one-sided rim is formed, the width and depth of which is equal to half the thickness of the component and that the rim is formed alternately on the upper and lower side of the planar component.

Different embodiments of the invention can be seen in the dependent patent claims in the attached patent claim set.

In its most simple form the invention is embodied in a planar component that is rectangular or which in a special instance also can have the form of a square. The panel, which can consist of one piece or can consist of two or more layers, has the thickness T. The edges are formed so, that a right-angled, one-sided rim is formed, the width and depth of which both equal T/2. The rim is formed alternately from the panels upper and lower side. In a square component the the change of side coincides with the midpoint of the side and in the corners, in a rectangular halfcomponent the change is in the midpoints of the longer sides and in the corners. In this way formed components can always be turned so the attaching edges fit together, independent of whether the long or short side of the components meets a short or long side. Using rectangular components made in the way described above can e.g. a cube be constructed using 12 components that are joined in pairs to form square components that form walls, floor and/or ceiling. The size and the placement of the rims enables joining two horizontally placed components in a corner with one vertically placed component. Likewise the ceiling or floor components can be mounted with the long sides parallel to each other or in right angle to each other.

When two components are joined in right angle they close tightly against each other on the inside. On the outside of the joint a groove is formed, the width of which equals the thickness T of the component and the depth of which equals T/2. To cover these and prohibit that e.g.moisture penetrates the joints, these grooves can be filled in and covered with covering strips, the length of which equals half the module measure (corresponding to the unbroken length of the grooves). These strips can in one end be formed as "quarter pyramids" so that three strips can meet in the corner of the building without leaving a visible void. If desired the outer corner of the strips can be rounded or profiled in different ways.

To make it possible to build usable constructions of the components we foresee at least two variations of the components:

1) A door component charcterized by an unprofiled opening in the middle of the component, symmetrically placed both vertically and horizontally. If the component is turned in a horizontal position the opening can be used as a window or a wide service hatch. Used as a floor or ceiling element the opening is big enough to accommodate e.g. a staircase passing through it.

2) A window component that has a smaller, unprofiled opening, placed symmetrically relative to the length axis of the component but assymmetrically relative to the transverse axis. This component can, placed horizontally, create a window opening on the right or left hand side of the component, placed vertically it can be turned so, that the opening is in the upper part, forming a window, or in the lower part, forming a service hatch etc

The unprofiled openings in the window- or door components make it possible to always orientate them in such a manner that the edge profiles mate with adjoining components while the opening is in the desired position. With the aid of e.g. additional strips or profiled edges on the door blade it can be mounted so it opens to the inside or the outside, lefthanded or righthanded. Likewise the window opening can be fitted with single or multiple glazing, fixed or opening.

Advantages of the invention

With a very limited number of different components (in the basic configuration three different, one closed, one window and one door component) a practically unlimited number of different constructions be conceived. The embodiment of the rim configurations around the edges facilitates and secures the mounting. The typically sturdy and homogeneous constructions of the panel components make them durable,

thereby enabling reuse of components when changes are done. The flexibility is further enhanced by the fact that the same component can be used as well as floor, wall or ceiling panel. Correctly dimensioned the basic units can contain a great diversity of functions. The possibility of using halfsized components makes it possible to keep the weight of single components low enough to facilitate handling, freight, mounting and demounting.

The invention is explained in a more detailed manner with examples referring to the attached drawings where:

Figure 1 shows the planar components in perspective individually and joined to form different configurations; the thickness of the components is exaggerated to facilitate noticing the details of the invention,

Figure 2 shows the same as figure 1, but obliquely from above and from the opposite direction,

Figure 3 shows a basic component with or without openings,

Figure 4 shows an approximately 5 square meters large building with door and window and

Figure 5 shows a sauna building, composed of three cubic room units; the sauna, the washing room and the locker room.

In figure 1 and 2 is clearly shown, thanks to the exaggerated thickness, that the edges of the components are shaped so that a rightangled, onesided rim 1, 2 is formed, the width and depth of which equals half the thickness of the component and the rim 1, 2 is alternately on the upper or lower side (left and right side)

In a component formed as a square 3 the change of sides takes place in the midpoint of each edge 4 and in the corners 5. In a rectangular component 6 the change of sides is in the midpoint of the longer side 7 and in the corners 8.

In figure 3 are shown two basic components where two plates 9, 10 are glued together, forming one square component, equal to component 3 in picture 2. In the components 11, 12 and 13 are sawed door and window openings. The extracted piece 14 is used as body of a door. The door body can be used as a door with or without a window opening 14, 15 or as a window component with the window oriented left 16 or right 17. The window 18 can be fixed or opening insulating glass.

Figure 4 shows a cubic building that has two components 12, 13 with window and door openings. The openings are provided with a window component 17 and a door component 15. The components have windows that can be fixed or opening. The building is provided with a sloping roof construction 19, supporting columns 20 and threads 21. The size of the building can be e.g. 2.2 m x 2.2 m x 2.2 m having a floor area of nearly 5 meter square and a volume slightly over 10 cubic meters. By joing three cubes with suitable doors and windows it is possible to construct e.g. a sauna building with a floor area of c. 15 meter squared, shown in figure 5. At the left is the sauna room, in the middle is the washing room and on the right is the locker room.

Possible variations of the invention

Components conceived according to the basic logic of this invention can be made in different sizes, with a different number of alternating rims on the edges. To make it technically possible to cover wider spans the floor or ceiling components can be attached to or laid at beams on their upper or lower side. If desired, a row of components, the edge profiles of which coincide with the profiles on the upper edges of the wall components so that between them can be mounted beams that support the ceiling components on top. In order to enhance the acoustic insulation between rooms each room can be constructed as a separate box with its own floor,walls and ceilings, leaving an air gap or flexible insulation between the units. In multistorey constructions the upper floors can be mounted "floating" on stiff mineral wool or other suitable damping material so that the footfall noise doesn't spread unhindered from one unit to another. Buildings, erected with a load bearing structure according to this invention can be equipped with additional insulation and sheltering against the weather e.g. formed as light hanging constructions.

The components can be joined to each other using known methods such as nails, screws, bolts, glue and tape. They can also be joined using purpose formed wedges that can be made of e.g. wood, metal or plastic. These wedges are placed in predrilled systematic holes in the rims in such a way that they lock both the components and the wedges to each other.

The surface of the components can be treated with covering materials that strengthen them against moisture, wear and fire. The surface can be visually treated and enhanced with patterns, decorations or pictures that can be made using generally known techniques such as milling, glowing, sandblasting and/or painting with or without stencil.

Correctly dimensioned the basic units that are formed by joining the components be so small that they do not meet the Building Act requirements for buildings, making it possible to erect them without building permission according to rulings regarding e.g. fire safety.

The invention is naturally not limited to above shown examples and drawings, but can be varied within the bounds of attached patent claims. The invention can also be used in the construction of cases, boxes, furniture etc. using e.g cubic threedimensional objects.

## Claims

1. Prefabricated component system for construction using planar component constructions forming e.g. cubic building parts that can be combined to small buildings such as saunas, summer lodges, guest cabins, grill or pizzoven shelters etc. **characterized** by that the planar components (6, 3) main form is rectangular/square and that the edges of the components are profiled in such a manner, that a rightangled, one-sided rim (1, 2) is formed, the width and depth of which is equal to half the thickness of the component and that the rim is formed alternately on the upper and lower side of the planar component.

2. Component system according to claim 1, **characterized** by that in a square component (3) the change of sides coincides with the midpoint of every side (4) and in the corners (5).

3. Component system according to claim 1, **characterized** by that in a rectangular halfcomponent (6) the change of sides coincides with the midpoint of the longer sides (7) and in the corners (8).

4. Component system according to claim 1, 2 or 3, **characterized** by that the component system is provided with a door component (15) with an unprofiled opening in the middle of the component, placed symmetrically both in horizontal and in vertical direction.

5. Component system according to some of the patent claims above, **characterized** by that the component system is provided with a window component (16, 17) that has a smaller, unprofiled opening, placed symmetrically relative to the length axis of the component but assymmetrically relative to the transverse axis

6. Component system according to patent claim 5, characterized by that the window opening is provided with a single glass (18) or insulated glass, fixed or opening.

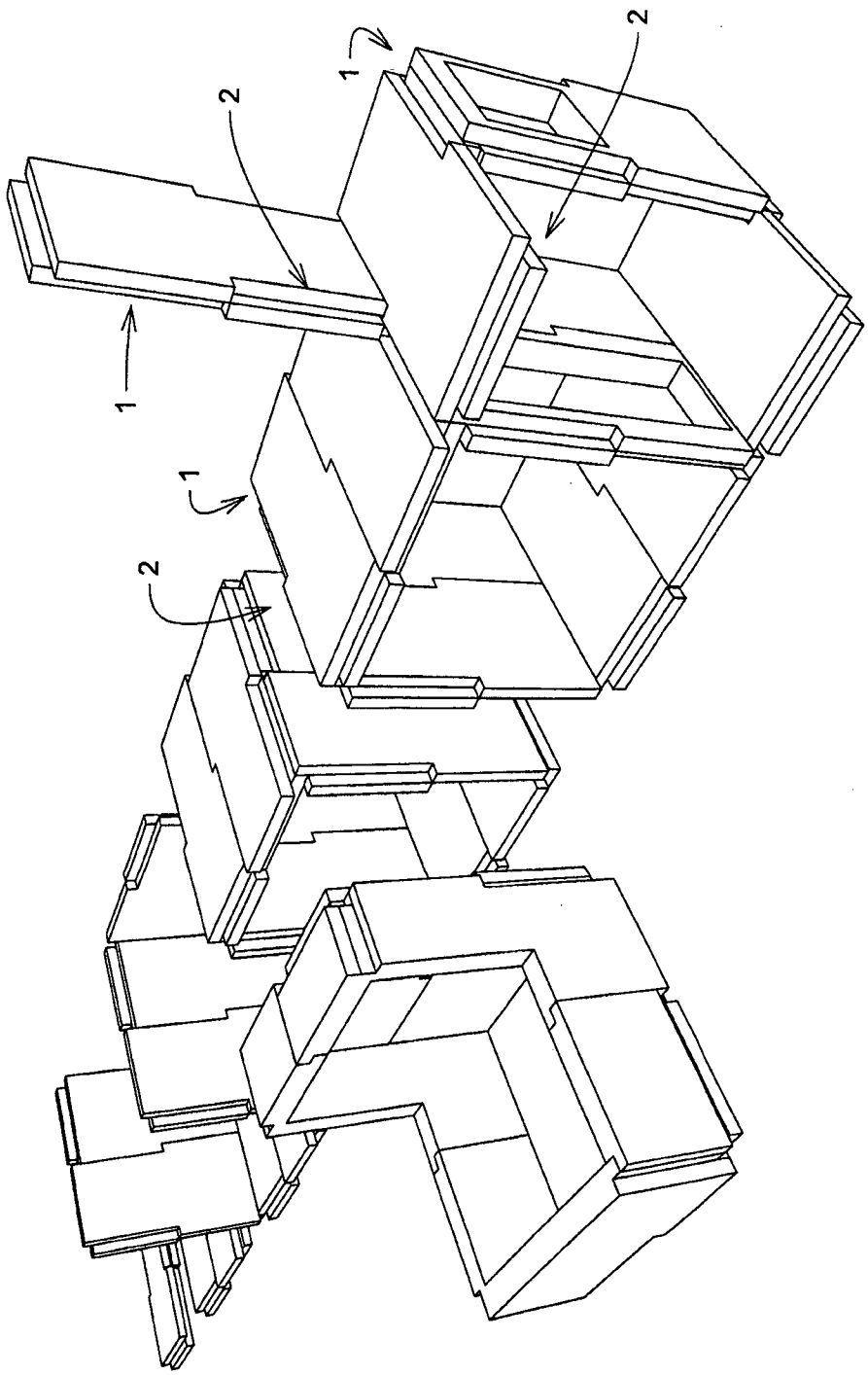



Fig. 1

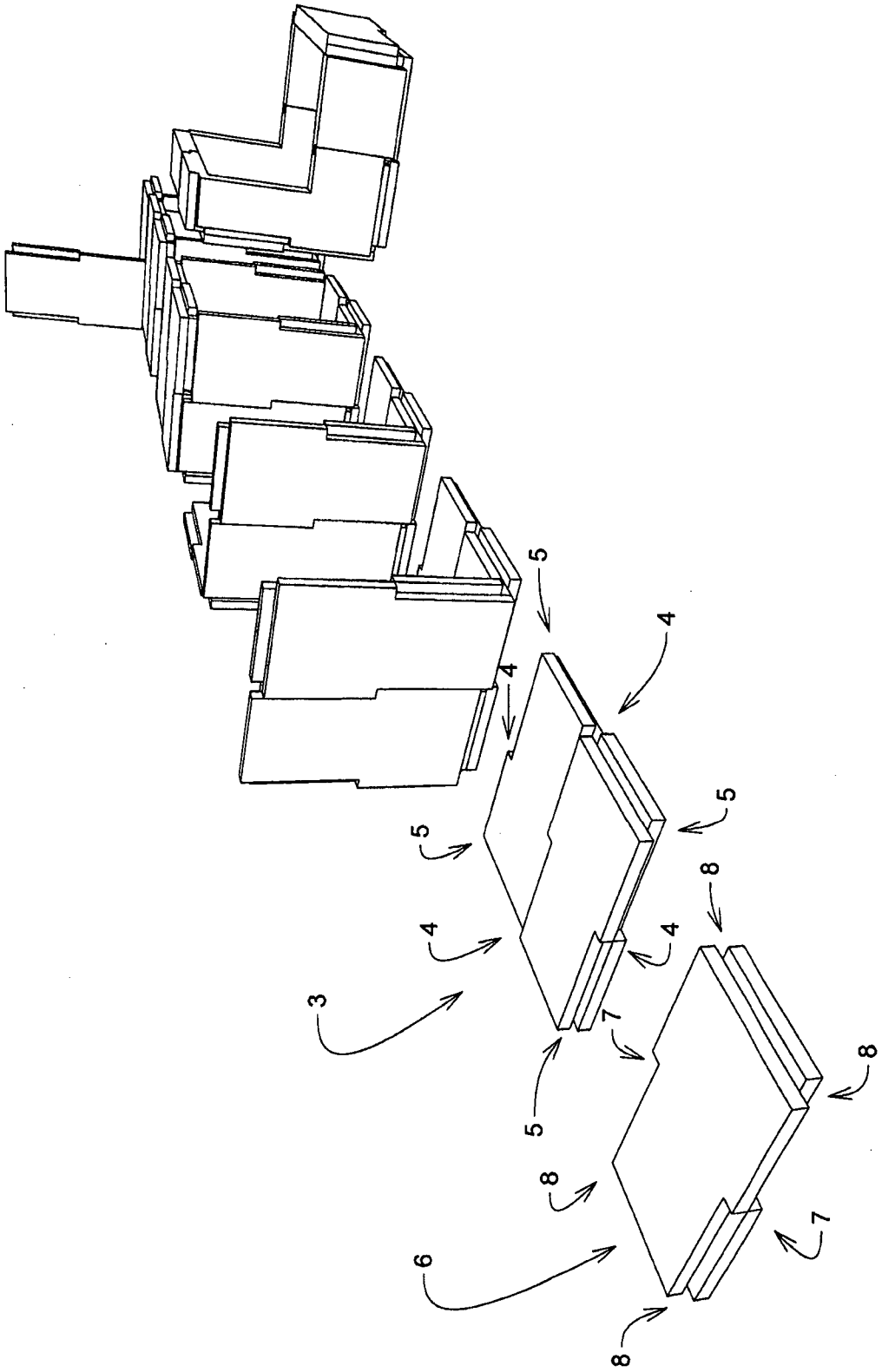



Fig. 2

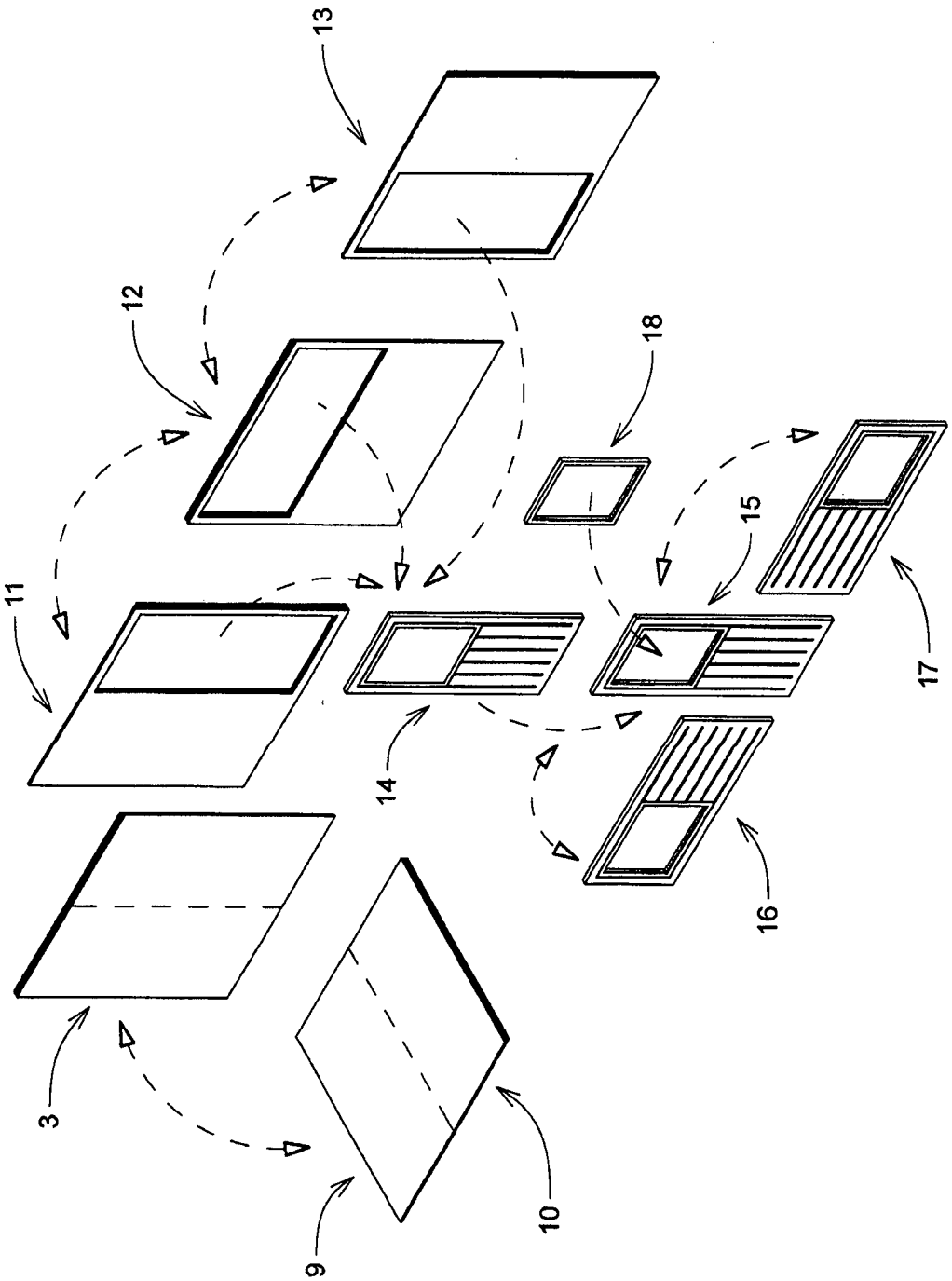



Fig. 3

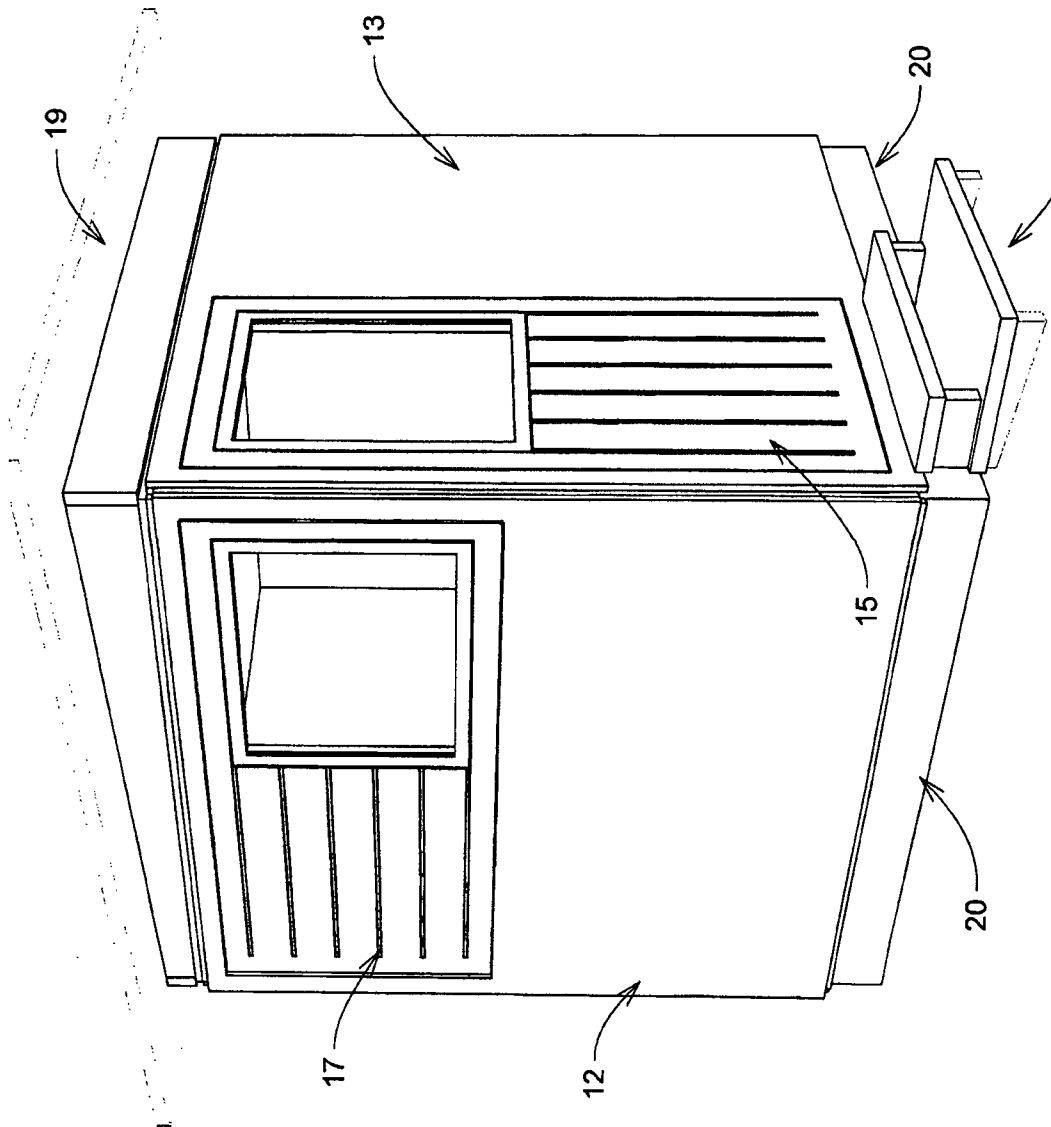



Fig. 4

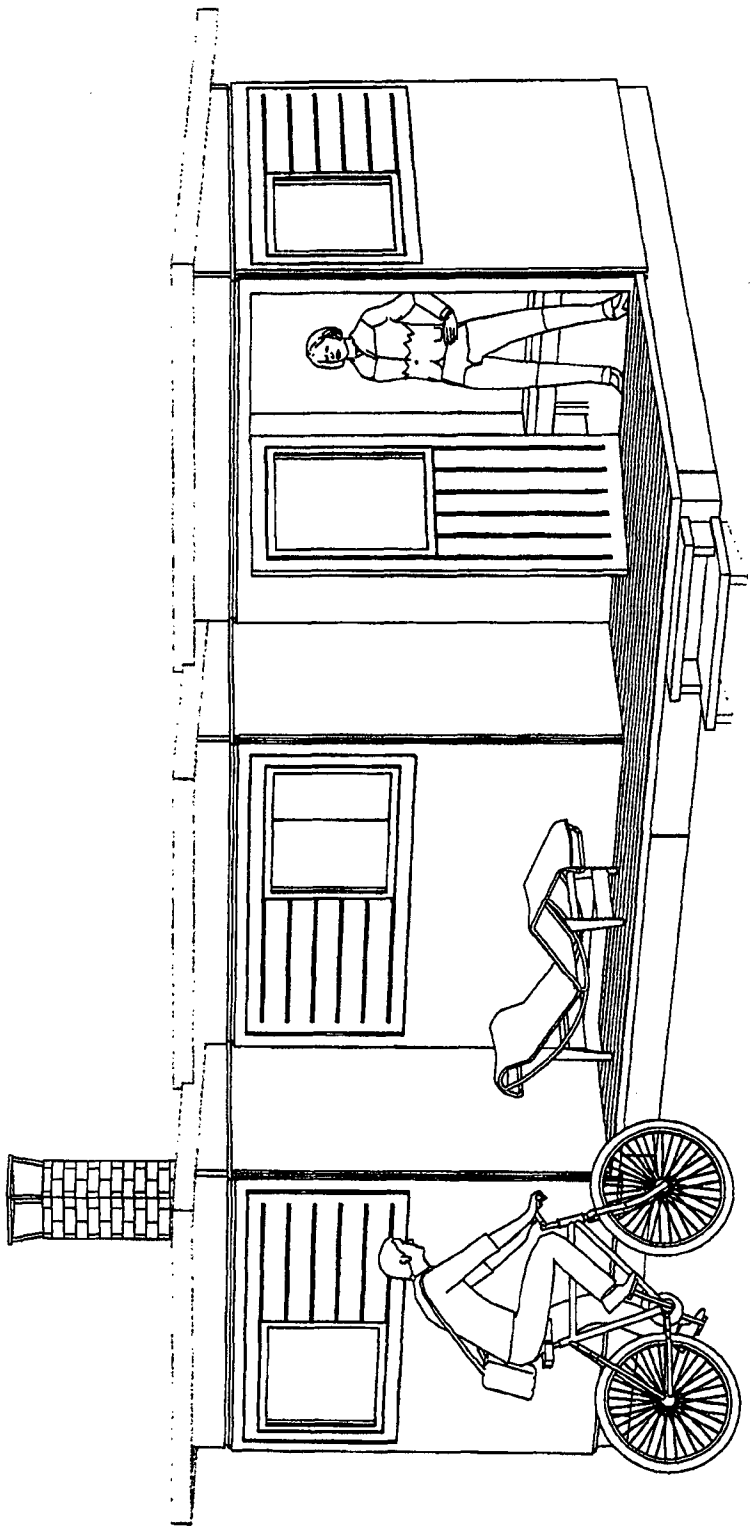


Fig. 5

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/FI2016/000012

A. **CLASSIFICATION OF SUBJECT MATTER**

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E04B, E04C, E04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base, and, where practicable, search terms used)

EPO-Internal, WPIAP

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5888612 A (NEEDHAM DONALD G [US] et al.)<br>30 March 1999 (30.03.1999)<br>entire document, specifically abstract; column 1, lines 1 – 21; column 4, lines 25 – 62; claims; figures 1, 2 | 1 - 6 |
| A | FR 2971276 A1 (PADOVANI FRANCOIS MARIE [FR])<br>10 August 2012 (10.08.2012)<br>figures & machine translation into English (Patent translate powered by EPO) [online] [retrieved 6.9.2016] | 1 - 6 |
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| A | US 4593513 A (STRATTON FRANK [AU]) 10 June 1986 (10.06.1986)<br>entire document; specifically figures 1 – 6f | 1 - 6 |

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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| Date of the actual completion of the international search | Date of mailing of the international search report |
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| 06 September 2016 (06.09.2016) | 12 September 2016 (12.09.2016) |

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International application No.
PCT/FI2016/000012

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| P, A | WO 2015087223 A1 (STORA ENSO OYJ [FI]) 18 June 2015 (18.06.2015)<br>entire document, specifically abstract; page 1, lines 1 – 27; page 4, line 4 – page 10, line 15; claims; figures 6, 7 | 1 - 6 |

**INTERNATIONAL SEARCH REPORT**
**Information on Patent Family Members**

International application No.
PCT/FI2016/000012

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International application No.
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CLASSIFICATION OF SUBJECT MATTER

IPC
***E04B 2/62*** (2006.01)
***E04B 1/10*** (2006.01)
***E04C 2/38*** (2006.01)
***E04B 1/61*** (2006.01)
***E04B 1/348*** (2006.01)