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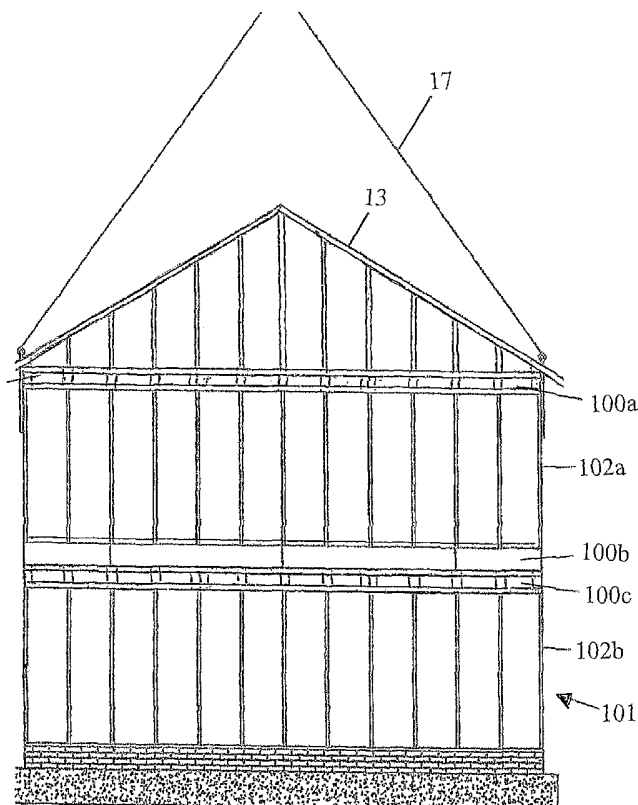
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(54) Title: RING BEAM STRUCTURE AND METHOD OF CONSTRUCTING A TIMBER FRAME



(57) Abstract: A ring beam structure (100) for use in constructing a timber frame (101) for a building comprises a plurality of rows (100a, b, c) of timber beams (1). Each row (100a, b, c) forms a ring beam wherein at least one row comprises a floor stage and at least one further ring beam comprises a roof stage. The floor and roof stages are assembled at ground level and releasably secured together allowing the ring beam structure (100) to be lifted clear for construction of the ground floor wall structure (102b). The ring beam structure is then lowered and the floor stage attached to the ground floor wall structure (102b). The floor stage is then released and allowing the roof stage to be lifted clear off for construction of the upper wall structure (102a) on the floor stage. The roof stage can then be lowered and attached to the upper wall structure to complete assembly of the timber frame (101).

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RING BEAM STRUCTURE AND METHOD OF CONSTRUCTING A TIMBER FRAME

- 5 This invention relates to ring beam structure, formed at ground level to support the lifting of incorporated joist and roof stages with a load-bearing form of a structure supporting and extending such structure for use in, for example domestic dwelling.

10 The invention has particular, but not exclusive, application to a form of ring beam structure that can be arranged such that a number of rows of timber beams thereof are stacked and have incorporated within or on top, joists and roof stages independent of soft landing systems and scaffold. More especially the invention concerns the use of such a structure with load bearing and supporting structures for the joist and roof stages to form for example, an independent, load bearing frame. A form of the load bearing and supporting structure can have a number of infill panels connected to one another through a combination of wind posts and vertical timber components with built-in voids which allow for the passage of services and the placement of insulation.

15 BACK GROUND OF INVENTION

It is well known to use insulation and concrete blocks to form load bearing structures such as in dwellings. Standard insulation and concrete blocks are made from aggregates extracted from the earth, and are bonded together with cement mortar limited to a favourable environment. The blocks are laid in approximately ten layers per storey height and as the blocks are a relatively small module within a larger structure, it enables them to be handled and positioned easily during construction and are very flexible in terms of on - site alterations needed from time to time.

20

The block form of construction does not provide for a selection of modern insulations which render cold bridging obsolete, this insulation requires an air gap either side, unfeasible with block work, without extending the width of the structure on the internal side with a number of additional grounds. The blocks also have no built-in voids for insulation or services. The blocks are compatible to a brick module and have wind resistance regards racking and along their vertical plane, but only when coupled to external brick/block work, hence the internal load bearing structure cannot be totally erected independent of internal skin, unlike timber frame which can.

25

Timber - frame is produced from timber which is sustainable and more user friendly, it is erected in storey height panels, and is not flexible in terms of on site alterations that maybe needed from time to time, due to the in-built lintel section usually needing to be moved. Timber frame can provide for insulation within its timber frame members, but this is usually positioned after services are installed as it restricts their passage.

30

5 The standard timber frame panel of today contains a complex framework of wall, lintel, window and doorway sections, resulting in a non stop bespoke production line, with a lot of wasted wall space. To compound the situation further, increasing depths of insulation are required to meet new thermal regulations, resulting in deeper wall sections. The overall effect is the production of larger, heavier and more cumbersome wall panels that needs significantly more factory, transport and site space and the use of heavy lifting equipment to be moved around.

10 Timber frame and insulation /concrete blocks construction forms are similar in overall width when coupled to the external skin and necessary insulation and cavity. Because of there story height construction they need a soft landing system in place to form joist stage and generally at roof stage as well, they also need external scaffold in place to achieve these stages. The soft landing systems and scaffold typically takes up precious site space when not in use, and restrict movement when in use.

15 The managing of site labour to construct a structure is also a complicated issue because so many trades rely on other trades to complete one stage before the follow on trade can complete theirs, for example on brick and block forms of construction ,carpenters need brick layers to build the structure up to first floor level, before carpenters can complete the joist section, the duration of which can vary depending on size, their arrangements, and weather, the carpenters then have to wait for brick layers to reach wall-plate level before they can complete the roof section, during these stages the brick layers are also waiting for the scaffold to be constantly heightened.

20 Timber frame addresses these issues by completing the whole inner structure, including walls, joist and roof sections with the scaffold for all these stages in place at the onset. Timber frame try to erect the main roof stage prior to assembly of structure and then lift to a spare location until required, because by completing a stage of the structure that can vary in time a great deal first, allows a more reliable time table for the remaining programmable stages. The advantages of having a programmable schedule system could significantly
25 reduce the amount of site deliveries required and road congestion, therefore saving on labour and transport.

SUMMARY

30 At least one embodiment of the present invention aims to provide a ring-beam structure formed at ground floor level, to support lifting of incorporated joists and roof stages, independent of scaffold and soft landing safety systems, as well as being designed to uncouple at a later stage and join the ongoing structure.

5 At least one embodiment of the present invention aims to provide a infill panel section to fasten together with like infill panel sections through a combination of vertical / horizontal timber components, fixed to vertically aligned wind posts, to form a load-bearing structure to support and extend the ring-beam structure independently.

At least one embodiment of the present invention aims to provide a number of alignment wind posts, at set distances, within the form of the structure, for fastening of in-fill panels and vertical timber components, as well as adding strength to the structure.

10 At least one embodiment of the present invention aims to provide a built-in void for services and insulation as well as a method for installing a multi foiled insulation with an air gap either side.

The present invention provides a form of a ring beam structure to support the lifting of the incorporated joists with floorboard attached and main roof section. The ring beam structure takes the form of three stacked rows (lower, middle and upper) of elongate timber beams arranged such that there ends thereof overlap and interlock with beams above and below in a cross bonded manner. The
15 bottom and top rows also form the lintel sections spanning windows and doorways.

The timber beams preferably comprise a number of vertically oriented timber components extending lengthways of the proposed external side of the beam and fixed to a panels of structural sheet material, with additional parallel horizontal timber plates fixed top and bottom. Additional parallel horizontal timber rails
20 are fixed to the proposed internal side of the structural sheet material, the length of the beam. Joists are set out within the middle row, the ends of the joist are fixed to a structural sheet material, replacing the beams in the region, and floorboard is added to the joists in the standard manner

To support and extend the ring beam structure a combination of infill panels , vertical components, and wind posts are connected, forming a load-bearing
25 structure.

The infill panel preferably comprise a number of , in use, horizontally oriented timber rails their ends the same length as the panel of structural sheet material to which they are fixed. A number of vertical oriented timber components are fixed to the face of the panel, along its vertical edges and up to the bottom edge of the horizontal rails. A gap equal to the width of the horizontal rail is left between the bottom end of the vertical timber component and top edge of the horizontal edge to allow the infill panel to be inter locked with the face of a like
30 infill panel in transport as well as a nail/screw free zone for services to be routed when in use.

An alternative infill panel (not shown) with a number of additional horizontal

rails fixed to the opposite side and additional vertical components which extend up onto the ring beam on the inside, may also be used.

5

The wind posts take the form of a length of timber, their depth equal to the width of sole/lower/upper plates. The wind posts are set vertically within the structure at set distances to comply with the length of the infill panels and/or window doorways positions. The wind posts are fastened to the infill panel through the infill panels vertical fixing timber components and horizontal rails, as well as to a sole-plate at its lower end and to the lower plate of the beam at its upper end at a later stage. Vertically positioned timber components are fastened to the proposed internal face of the wind post and to the vertical fixing timber components in the infill panel, tying them together. The vertically positioned timber components also extend/fix to the beams above, and sole-plate below, tying all sections of the structure together. On alternative infill panels it maybe advantageous to replace the vertical positioned components with horizontal positioned components.

10

Extended wind posts (not shown) may extend through a gap equal to their depth and width in the lower plate and structural sheet material of the lower and upper ring beams, the top ends of the extended posts to the underside of upper plates, It may be advantageous to reverse the proposed external/ internal sides of the beams to achieves this.

15

One of the options to incorporate insulation within the wall system is to place a lining of insulation to envelope the internal side of the wind posts/beam and infill panels (eliminating cold bridging) prior to the positioning and fastening of the vertical positioned timber components. Services maybe then routed in the void between the insulation (not shown) and vertically positioned timber components.

20

The invention will now be described in more detail by way of example only with reference to the accompanying drawings wherein:

Figure 1 shows one side and the proposed internal view of a timber beam for constructing a ring beam structure embodying the invention.

25 **Figure 2** shows one side and the proposed external view of a timber beam for constructing a ring beam structure embodying the invention.

Figure 3 is an end view of the timber beam shown in Figure 17 and 18;

Figure 4 is a side view of a ring beam structure constructed from timber beams of Figures 1 -3

30 **Figure 5** shows a section of ring beam of Figure 4 showing the ring beam structure with the roof trusses and lifting bars and seating of joists;

Figure 6 shows a section of ring beam structure of Figure 4 running parallel with joists

5

Figure 7 is a side view similar to Figure 4 with roof trusses fixed on top;

- 5 **Figure 8** is a side view similar to Figure 7 showing gable panels and the lifting cable attached to the lifting bars;

Figure 9 is a side view similar to Figure 8 showing the ring beam structure raised clear off the ground;

Figure 10 is a side view of an infill wall panel;

- 10 **Figure 11** is a side view of a load bearing wall structure constructed from infill wall panels of Figure 10;

Figure 12 is a side view showing the wall structure for the ground floor;

Figure 13 shows the ring beam structure of Figure 9 lowered onto the ground floor wall structure of Figure 12;

- 15 **Figure 14** shows the floor and joist sections of the ring beam structure separated from the roof section and secured to the ground floor wall structure of Figure 13 and the roof section of the ring beam structure lifted clear;

Figure 15 is a side view showing the wall structure for the upper floor located on the floor and joist sections of Figure 14;

Figure 16 shows the roof section of the ring beam structure lowered onto the upper floor wall structure of Figure 15;

- 20 Referring now to Figures 1 to 16 of the accompanying drawings, the embodiment of a ring beam structure 100 according to the invention and a timber frame 101 for a two storey building such as house constructed with the ring beam structure 100 is shown. For convenience, reference numerals are used to indicate parts of the embodiment.

- 25 Figures 1 to 3 show a timber beam 1 for assembly with like beams 1 overlapping and interlocking with beams 1 above and below in a cross bonded formation to form a ring beam structure 100 (Figure 4) for use in the construction of a timber frame 101 (Figure 16) to form the inner leaf of a building to be faced with an out leaf or skin of brickwork.

- 30 The timber beams 1 each comprise a panel 3 of structural sheet material e.g. 2400 mm x 224 mm x 12 mm structural plywood, to one side of which a number of vertically oriented timber components 2, each 224 mm in height x 89 mm in width and 38 mm in depth, are secured along the length of the beam 1. The components 2 extend transverse to the length of the beam 1 at 600 mm centres between upper and lower plates 10 for example 2400mm in length x 89mm in width and 38mm in depth are fixed along the top and bottom of the components 2. In this embodiment, the dimensions of the timber beams 1 are

6

2400 mm in length, 300 mm in height and 89 mm in depth.

- 5 Two lengths of parallel bridging rails 5 for example 89mm in depth and 38mm in width are fixed (on-site) to the other side of the panel 3 and secured through panel 3 into components 2 and also to the upper and lower plates 10. The two spaced parallel bridging rails 5 extend along

- the length of the panel 3 to span all window/doorway openings and joining ends of beams 1. All voids between components 2, and ply panel 3, and/or between bridging rails 5 may be filled with a rigid insulation board (not shown). A structural sheet material (not shown) may also be fixed to the face of rails 5 spanning over window/doorway openings reinforcing the area.

- 10 The ring beam structure 100 consists of three crossed bonded rows 100a, 100b, 100c (top, middle and bottom) of timber beams 1, such that the ends of the beams 1 in each row 100a, 100b, 100c butt up and overlap and interlock with the rows above and below (Fig. 4). Each row 100a, 100b, 100c may consist of any number of beams 1 depending on the size of the structure to be formed.

- 15 Floor joists 11, for example, Eco joists 262 mm in height are set out on the top of the bottom row 100c with their ends overlapping the beams 1 below and fixed to a number of single panels 3a of structural sheet material, for example 2400 x 300 x 12 mm structural plywood, that cover the ends of the joists 11. Lengths of for example 89mm in width x 38mm in depth packing 15 is fixed on top of the joist ends (Fig. 5) its top face aligned with top face of upper plate in row 100b in (Fig 6) as well as being aligned with the external edge of the upper and lower plates 10 of the beams 1 of the top and bottom rows 100a, 100c above and below the joists 11, in a cross bonded formation (Fig. 4). The seated ends of joists 11 and panels 3a replace the beams 1 of the middle row 100b (Fig. 5).
- 20 Areas of the middle row 100b running parallel with joists 11 are in-filled with beams 1 (Fig. 6).

- A number of lifting bars 19 (Figs. 5, 6) for example 1050 mm in height and 36 mm in diameter are provided on the external side of the ring beam structure 100 to lift the ring beam away from the lower sole plate 10a. The lower ends of the bars 19 are level with the lower edge of the bottom row 100c of beams 1. The upper ends of the bars 19 protrude above the top row 100a of beams 1 and have a ring shaped lifting eye 19a for lifting the ring beam structure 100 by crane.

- 25 The bars 19 extend above the impending roof line and have bolt holes to align with holes in upper, lower row 100a, 100c, of beams 1 for the passage of bolts 18 (Figs. 6, 7) to secure the bars 19 to the ring beam structure 100. Floor boards 12 are then fixed to the joists 11.

- 30 The trussed roof 13 is fixed onto beams 1 of top row 100a to complete construction of the ring beam structure 100 at ground floor level without the need for safety soft landing systems and scaffold (Fig.7).

Gable panels 14 formed from a combination of infill panels 4, wind posts 7, vertical positioned components 9 are fixed to the trusses of the gable ends,

- 5 Full scaffold (not shown) with staging heights set for bricklayers/external cladding can then be assembled and lifting cables 17 attached to the lifting bars 19 (Fig.8) so that the ring-beam structure 100 can be lifted off the soleplate 10a (Fig.9) by crane (not shown). A combination of infill panels 4, wind posts 7, and vertical components 9 can then be assembled and connected (Figs. 10,11) to form a load-bearing wall structure 102b (Fig.12) for the ground floor of the building.

- 10 Each infill panel 4 (Fig. 10) comprises, for example 12 mm structural ply panel measuring 562 mm in width x 2062 mm in height to which three horizontal timber rails 6a, 6b, 6c, and four vertical fixing components 8 are fixed to the inner face. The rails 6a, 6b, 6c are for example 562 mm in length x 89 mm in height and 38 mm in depth, and are fixed at the top, bottom and middle of panel 4. The vertical fixing components 8 are for example 807 mm in length x 45 mm in width and 35 mm in depth, and are fixed along vertical edges of the panel 4. A gap equal to the width of rails 6a, 6b, 6c is left between the bottom end of the vertical timber component 8 and the top edge of rails 6a, 6b, 6c to allow the
15 infill panel 4 to be interlocked with the face of a like infill panel 4 in transport as well as provide a nail/screw free zone for services to be routed when in use.

The wind posts 7, are for example 2062 mm in height x 38 mm in width and 89 mm in depth, and are set vertically within the structure at 600 mm centres to comply with the height of the infill panels 4 and/or window/doorway positions. The infill panels 4 are fastened to the wind posts 7 through the vertical fixing components 8, as well as to sole-plate 10a, and at a later stage to lower plate 10 in row 100c of the ring beam structure 100.

- 20 Vertically positioned timber components 9, for example 2400 mm in length x 89 mm in width x 38 mm in depth, are fastened to the face of the wind post 7 and vertical timber components 8, tying them together. The vertically positioned timber components 9 also extend/fix to the sole-plate 10a below and, at a later stage, to beams in row 100c of the ring beam structure 100 above tying all sections of structure 100 together.

- 25 Services may be routed freely within the void between the rails 6a, 6b, 6c and vertically positioned components 9. A rebated rigid insulation panel (not shown) is fixed in the external recess between posts 7 and panel 4, further insulation may be added between rails 6a, 6b, 6c on the internal side of the wall.

- The ground floor wall structure 102b (Fig. 12) is assembled from the ground up in the sequence outlined above and fixed to the uncovered ground floor soleplate 10a. Restraint straps (not shown) are attached to the outside of the ground floor
30 wind posts 7 at 1.8 m centres for later tying the structure to the outer-skin brickwork/external cladding (not shown).

5 The ring beam structure 100 is then lowered by the crane onto the ground floor wall structure 102b and secured (Fig. 13). The structure now looks like a bungalow. The bottom and middle rows 100c, 100b of the ring beam structure are then detached from the lifting bars 19 and the top row 100a of the ring beam structure 100 is lifted off by the crane utilising the lifting chains connected to the lifting eyes 19a of the lifting bars 19 (Fig. 14).

10 A load bearing wall structure 102a for the upper floor of the building is then assembled onto a newly installed sole-plate 10a of the 1st floor in similar manner to the wall structure 102b of the ground floor and fixed to the structure (Fig. 15). The wall structure 102b is constructed with openings (not shown) for all windows of the upper floor. The top row 100a of the ring beam structure 100 with attached roof trusses 13 is then lowered onto the upper wall structure 102b and fixed (Fig. 16).

15 The combined ring beam structure 100 (Figure 8) and load bearing supporting wall structures 102a, 102b acts in the same way as a traditional structure in that it takes dead, live and snow load from floors and roof construction, and supports its own self weight, but differs by resisting wind loads independently, allowing the completion of inner leaf of a structure, including roof and joists stages, in advance of outer leaf skin.

As will now be appreciated, the present invention provides a ring beam structure incorporating floor and roof stages that can be pre-fabricated at ground level and allows the floor and roof stages to be separated and built-into a load bearing and supporting wall structure to form a timber frame,

20 It will be understood that the invention is not limited to the embodiments above-described and that various modifications are possible. For example, the ring beam structure may comprise a roof stage and one or more floor stages. The roof and floor stages may be of any suitable construction that allows them to be separated during construction of the timber frame. The load bearing and supporting wall structures may also be of any appropriate construction.

25

CLAIMS

1. A ring beam structure for a timber frame building, the ring beam structure comprising a plurality of rows of timber beams arranged one on top of the other, each row forming a ring beam, wherein at least one row comprises a floor stage and at least one further ring beam comprises a roof stage wherein said floor and roof stages are releasably secured together.
2. A ring beam structure according to claim 1 wherein said floor stage incorporates floor joists.
3. A ring beam structure according to claim 2 wherein said floor stage comprises upper and lower ring beams and the floor joist are incorporated in the upper ring beam so that the ends of the joists rest on the lower ring beam.
4. A ring beam structure according to claim 2 or claim 3 wherein the floor stage incorporates floor material secured to the joists.
5. A ring beam structure according to any one of the preceding claims wherein said roof stage incorporates roof trusses.
6. A ring beam structure according to any one of the preceding claims wherein the timber beams comprise vertical timber components and horizontal panels on one or both sides.
7. A ring beam structure according to claim 6 wherein the timber beams are joined end to end by means of parallel components fixed to one side.

8. A ring beam structure according to any one of the preceding claims wherein means is provide for lifting the ring beam structure as a complete unit.
- 5 9. A ring beam structure according to claim 8 wherein the lifting means comprises a plurality of lifting points spaced apart around the roof stage such that the roof stage can be lifted off the floor stage when the roof and floor stages are separated.
- 10 10. A ring beam structure according to any one of the preceding claims comprising a plurality of floor stages arranged one on top of the other with the roof stage arranged on top of the uppermost floor stage wherein the floor stages and roof stages are releasably secured together.
- 15 11. A timber frame for a building comprising a plurality of load bearing and supporting wall structures arranged one above the other, a ring beam structure incorporating a floor stage arranged between and connected to successive wall structures, and a ring beam structure incorporating a roof stage arranged on and connected to the uppermost
20 wall structure.
12. A timber frame according to claim 11 wherein the ring beam structures are constructed as a pre-fabricated unit with the ring beam structures placed one on top of the other and releasably secured together
25 whereby the ring beam structures can be uncoupled from the pre-fabricated unit during construction of the timber frame.
13. A timber frame according to claim 11 or claim 12 wherein each floor stage comprises upper and lower rows of beams of which the lower
30 row supports floor joists of the upper row and provides a structural member extending over openings in the timber frame.

14. A timber frame according to any one of claims 11 to 13 wherein the wall structures comprise in-fill panels extending between and secured to vertical posts.

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15. A timber frame according to claim 14 wherein a plurality of in-fill panels are provided between each pair of adjacent vertical posts, and fixed to vertical timber components which extend and connect to the ring beam above.

10

16. A timber frame according to any one of claims 11 to 15 wherein the load bearing and supporting wall structures incorporate insulation material.

15 17. A timber frame according to any one of claims 11 to 16 wherein the load bearing and supporting wall structures are adapted to accommodate service pipes and/or wiring.

20 18. A timber frame according to any one of claims 11 to 17 comprising a ground floor load bearing and supporting wall structure and a first floor load bearing and supporting wall structure.

25 19. A timber frame according to claim 18 wherein the floor stage is provided between and connects the ground floor and first floor load bearing and supporting wall structures and the roof stage is provided on top of the first floor load bearing and supporting wall structure.

30 20. A method of constructing a timber frame for a building, comprising forming a ring beam structure at ground level comprising a plurality of rows of timber beams arranged one on top of the other, each row forming a ring beam, wherein at least one row comprises a floor

stage and at least one further ring beam comprises a roof stage wherein said floor and roof stages are releasably secured together, forming a load bearing and supporting wall structure, placing the ring beam structure on top of the load bearing and supporting wall structure and attaching the

5 floor stage thereto, releasing the secured floor stage from the ring beam structure and lifting the ring beam structure clear of the floor stage, forming a further load bearing and supporting wall structure on top of the floor stage, placing the ring beam structure on top of the further load bearing and supporting wall structure and attaching a further floor stage

10 or the roof stage thereto.

1/8

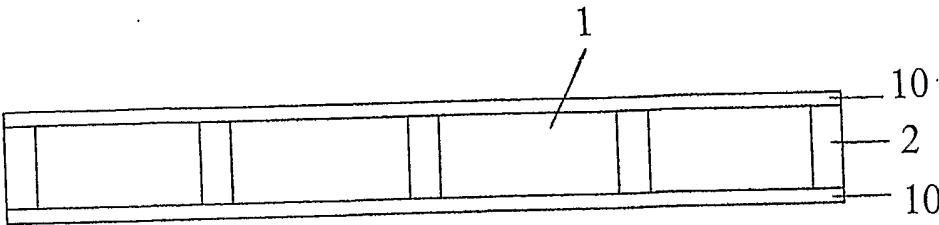


FIGURE 1

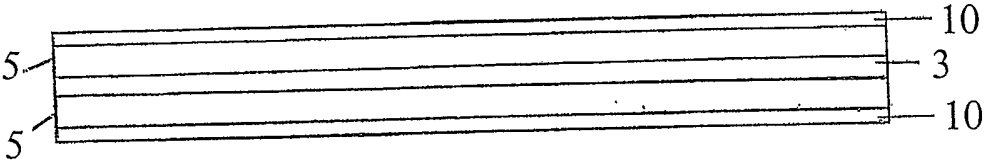


FIGURE 2

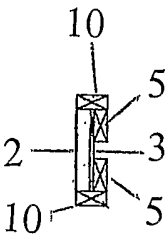


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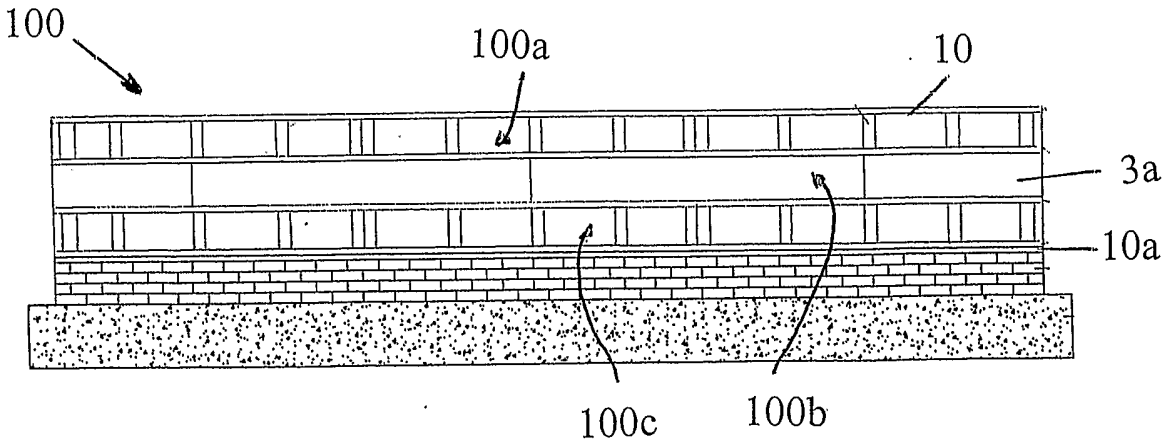
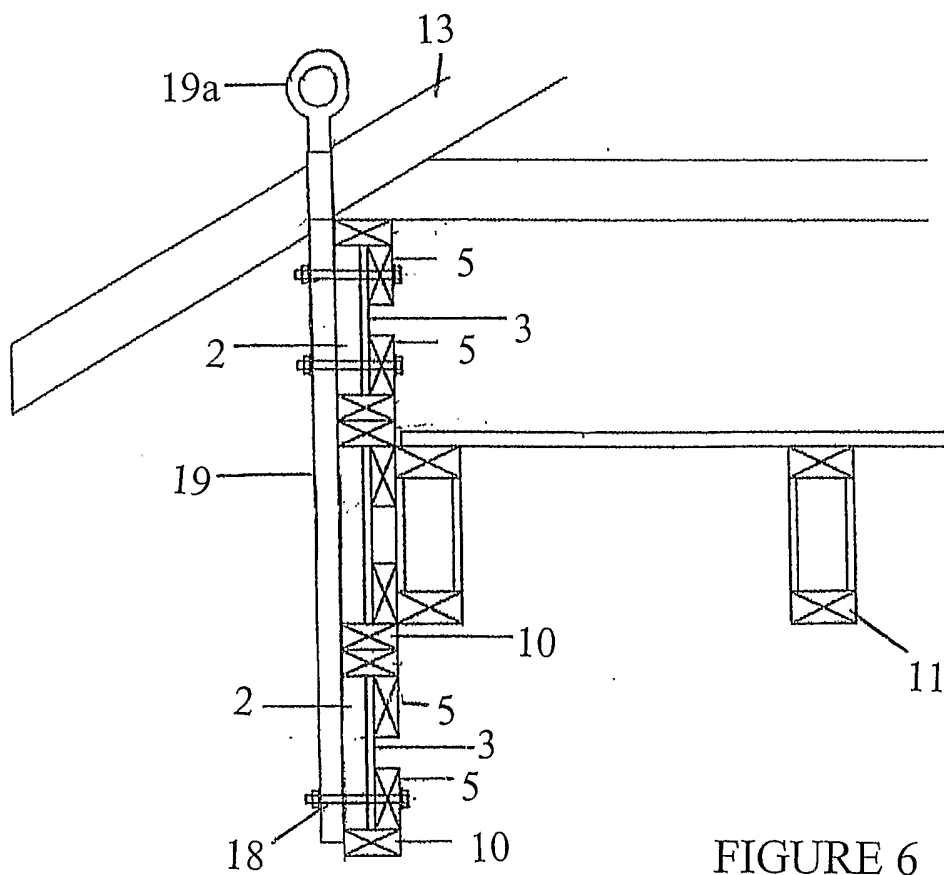
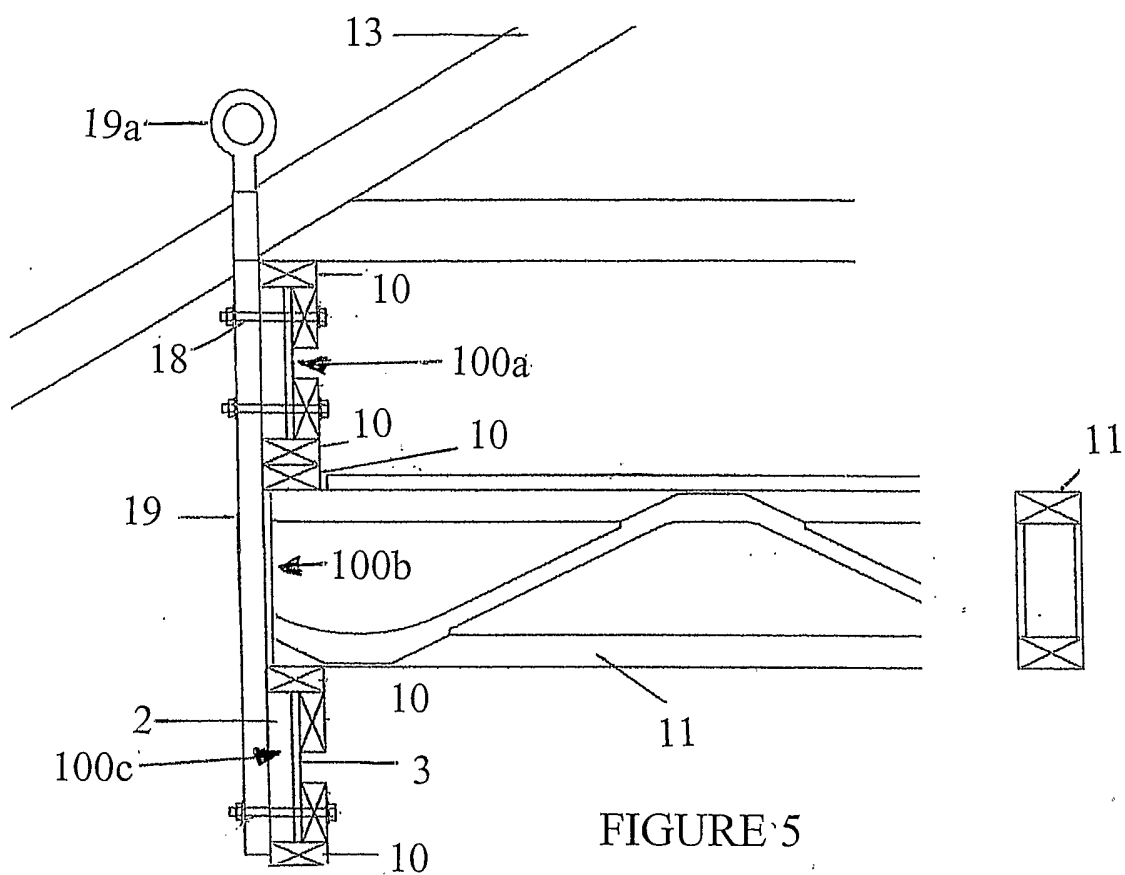


FIGURE 4

2/8



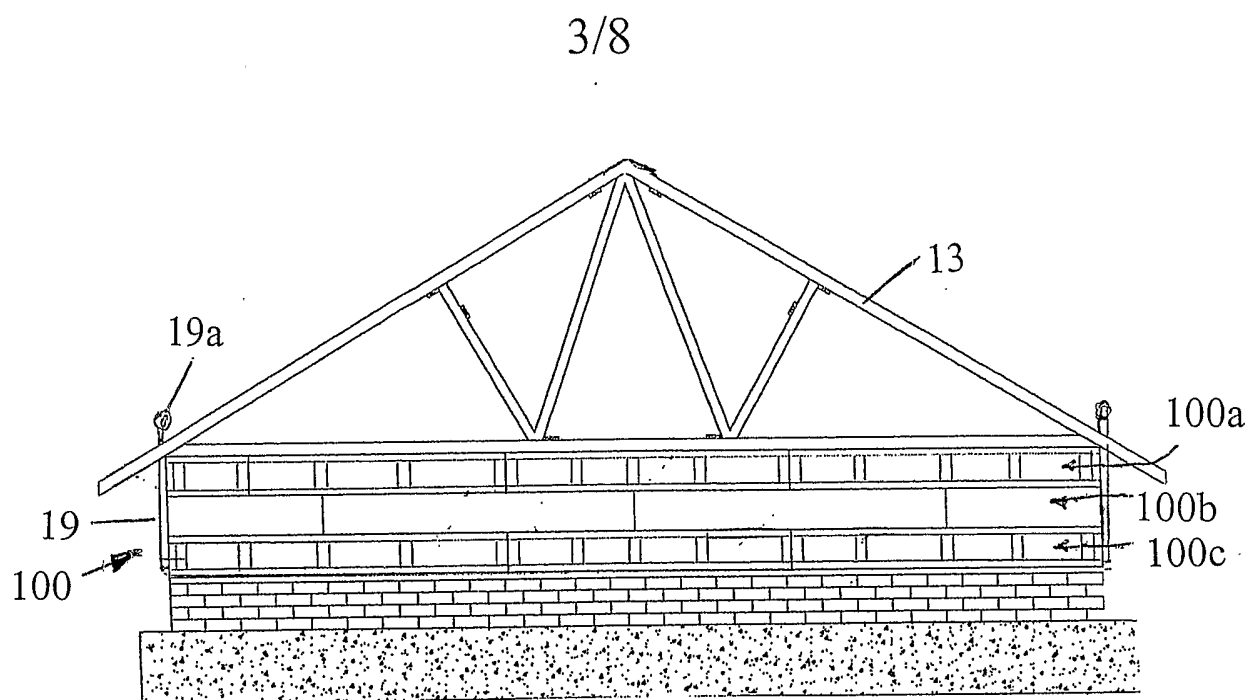


FIGURE 7

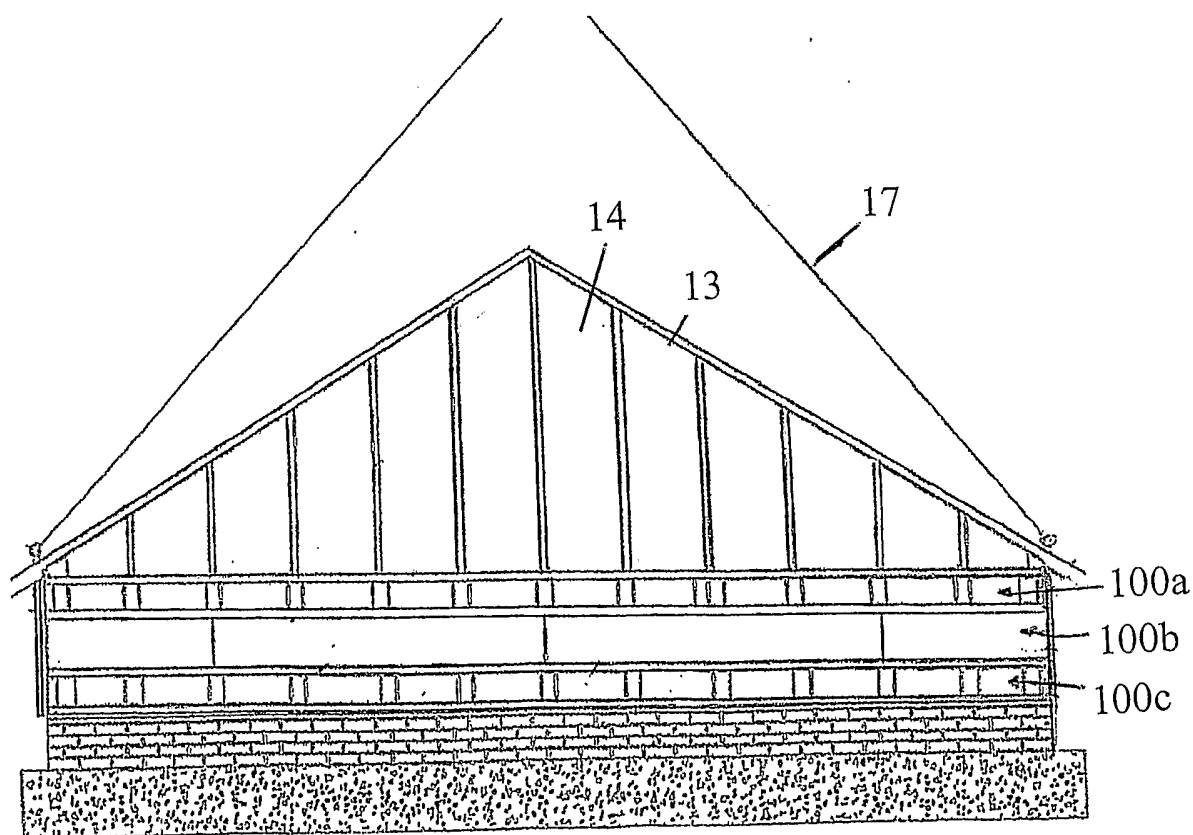


FIGURE 8

4/8

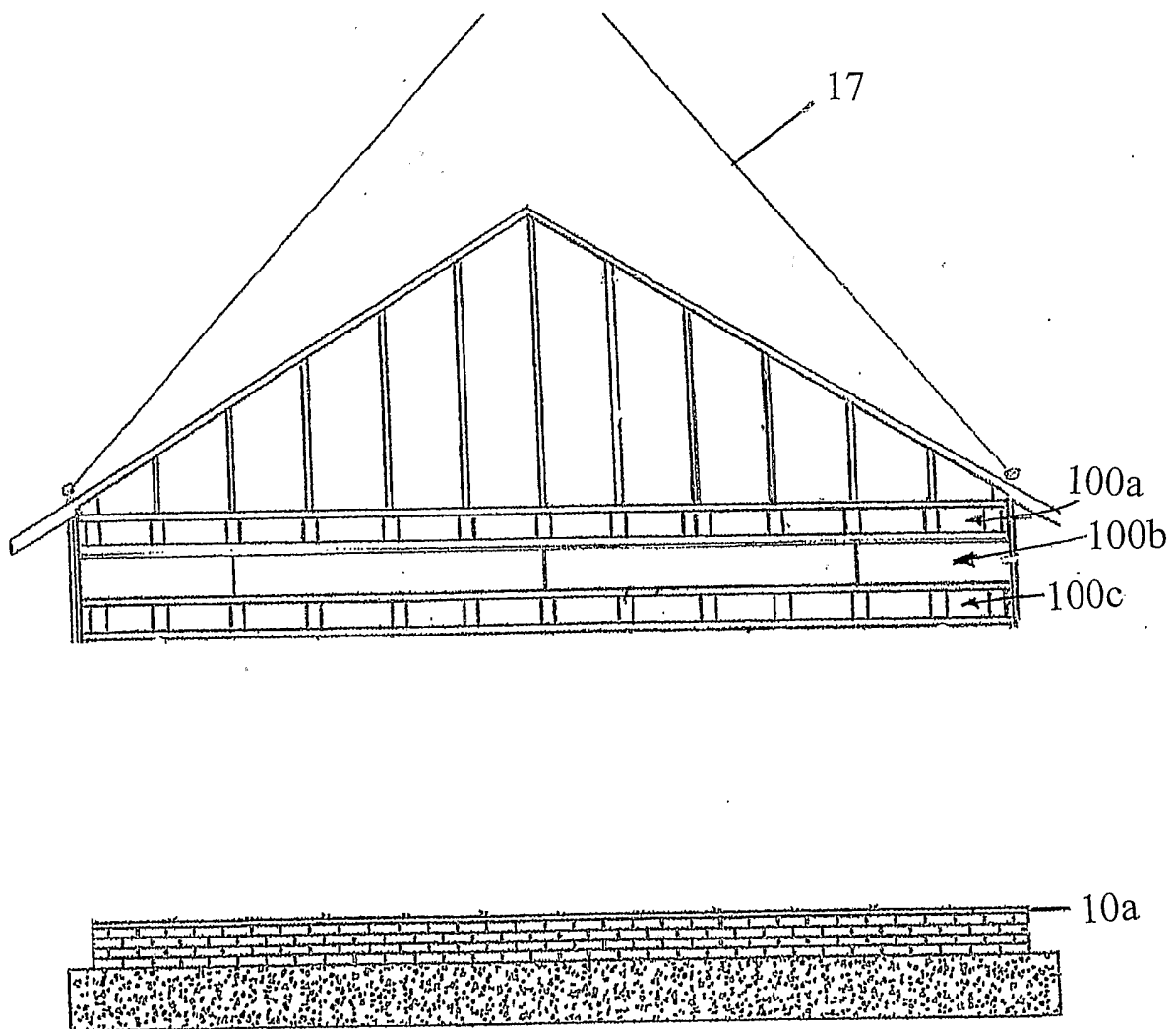


FIGURE 9

5/8

FIGURE 10

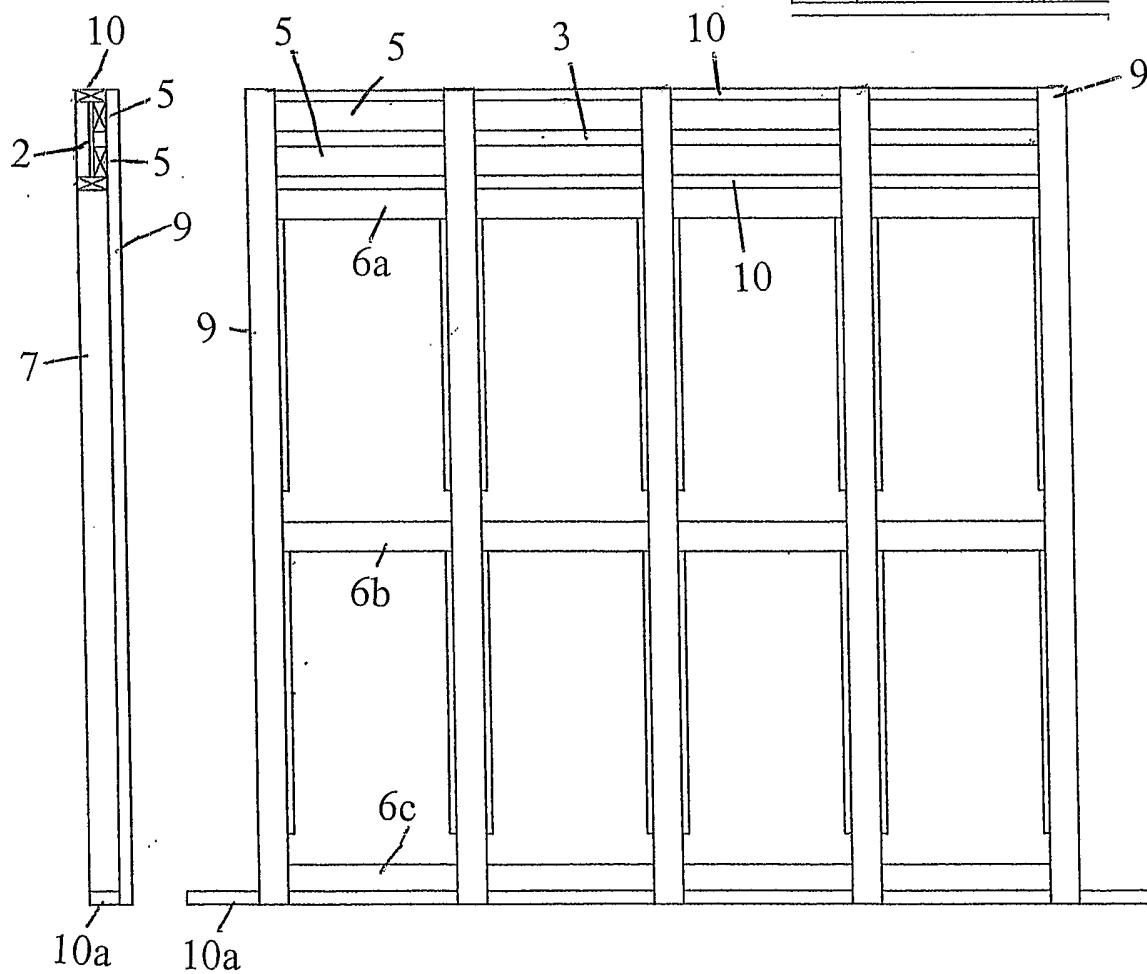
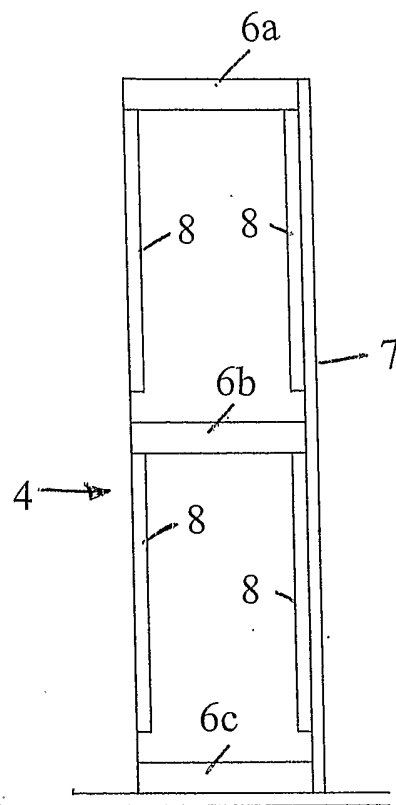


FIGURE 11

6/8

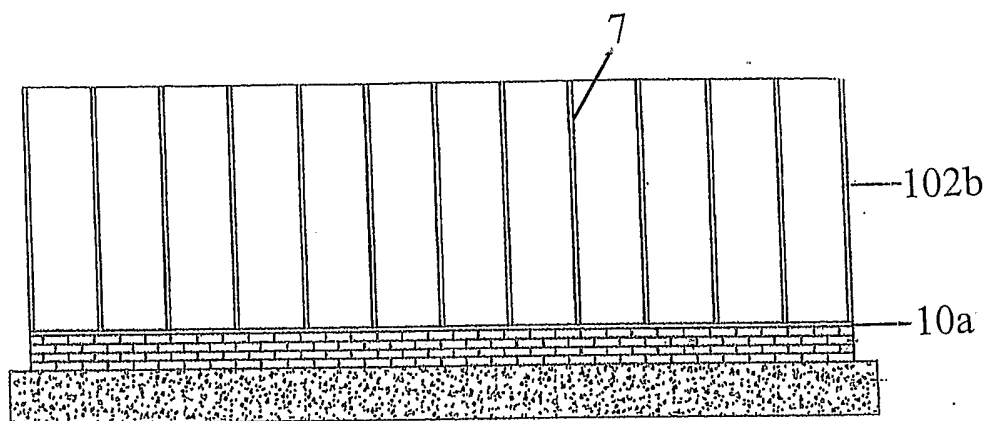


FIGURE 12

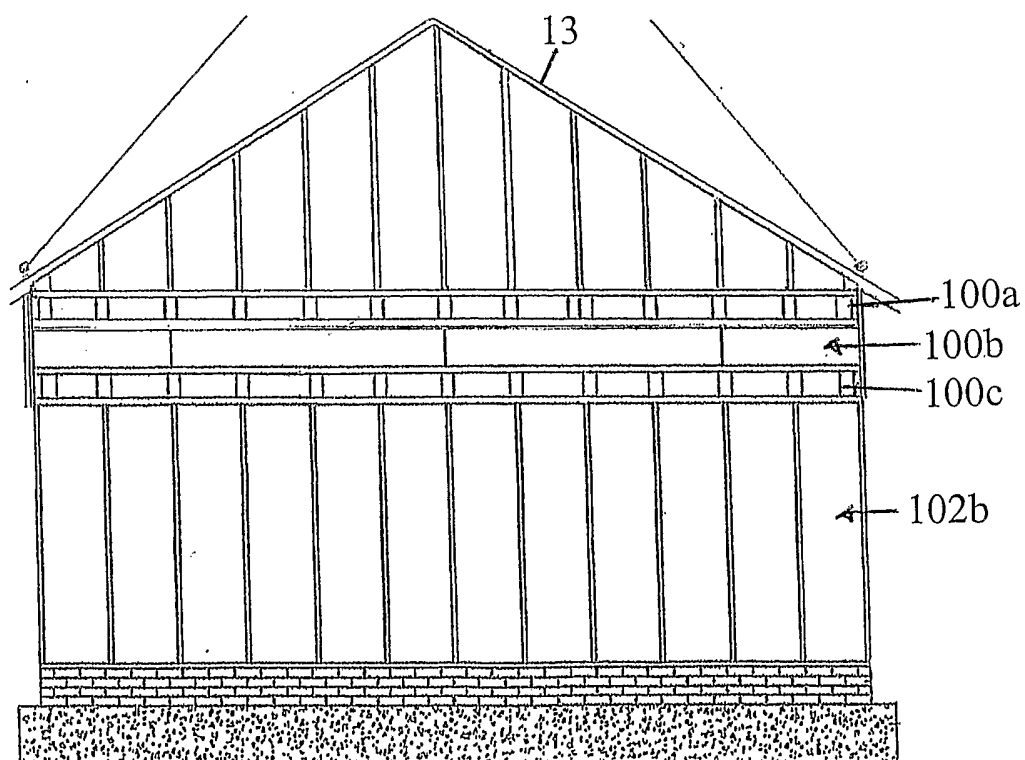


FIGURE 13

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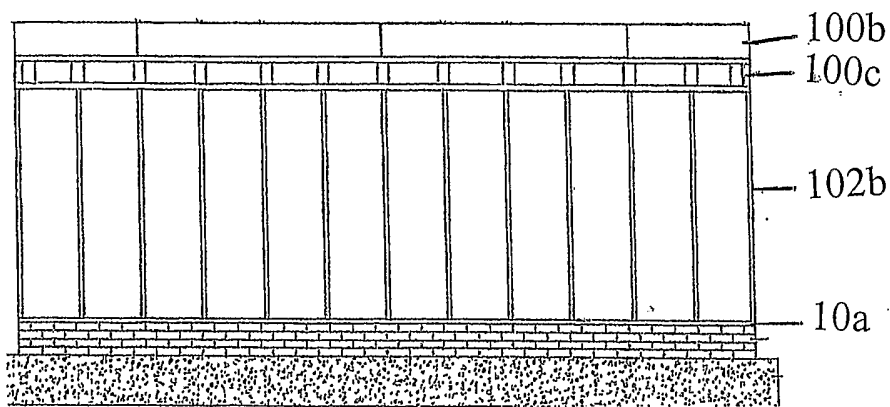
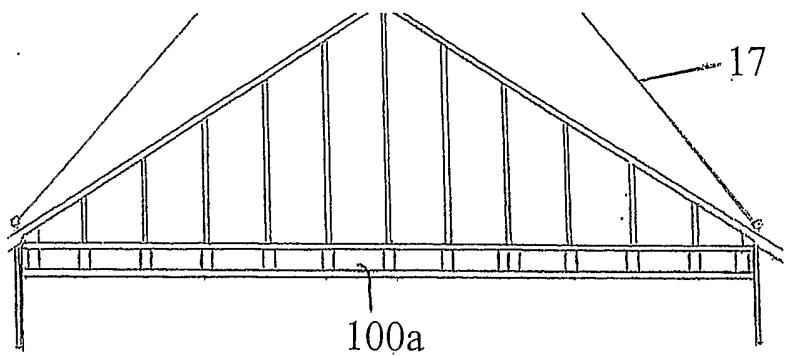


FIGURE 14

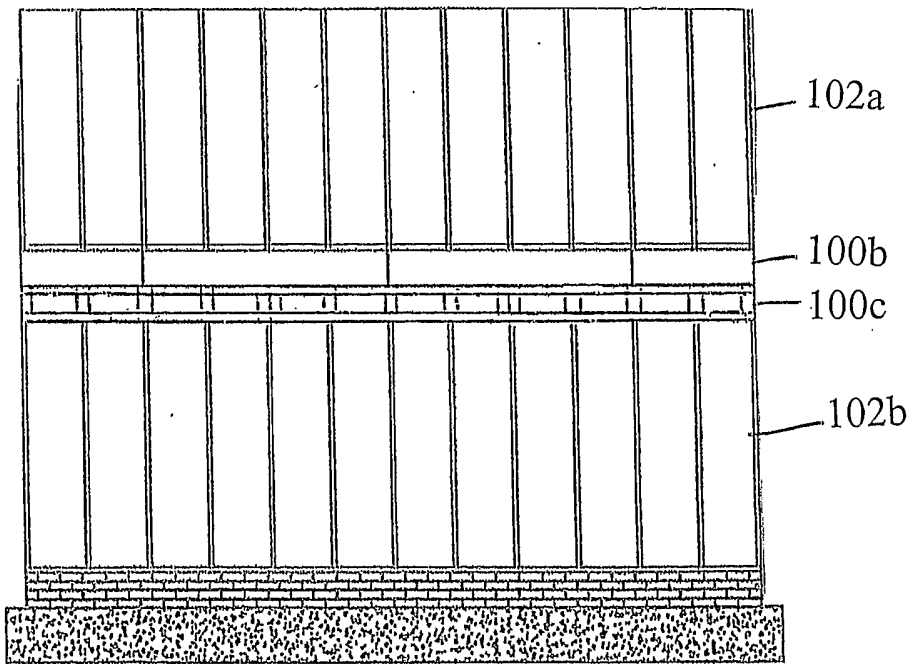


FIGURE 15

8/8

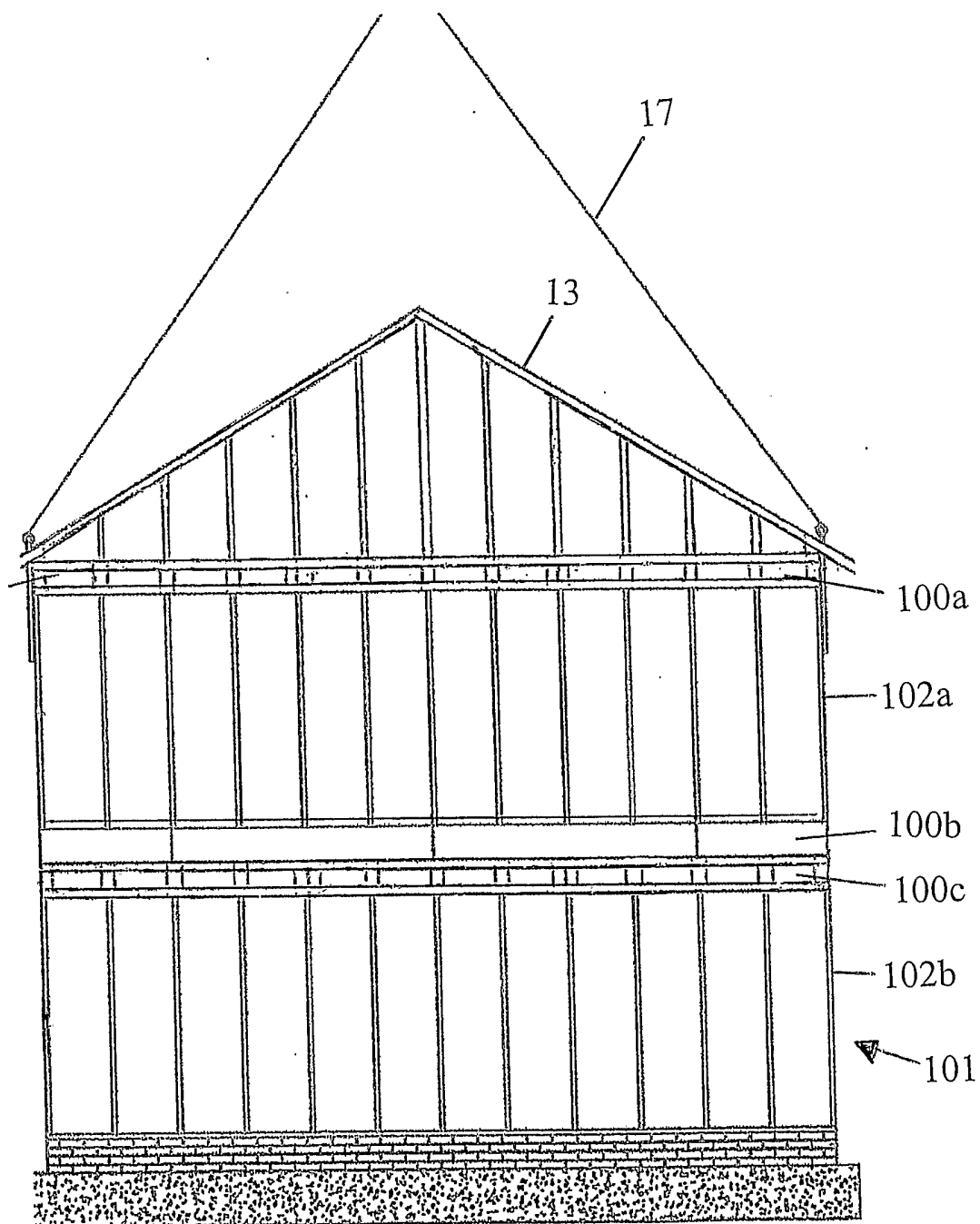


FIGURE 16

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/001308

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04B1/26 E04B1/35

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)
E04B

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 486 565 A (LACOSTE MAURICE) 15 January 1982 (1982-01-15)	11,14-19
Y	page 5, line 32 - page 6, line 22; figures 1,2	13
X	US 2 193 550 A (JR. THOMAS H. COE,) 12 March 1940 (1940-03-12) figures 1-11	11,18,19
Y	GB 2 321 473 A (* WALLTEC SYSTEMS LIMITED) 29 July 1998 (1998-07-29) figures 5,6	13
A	FR 2 051 634 A (HIRVENSAALO KAARINA) 9 April 1971 (1971-04-09) the whole document	20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

5 July 2006

Date of mailing of the international search report

25. 07. 2006

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2006/001308

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			DE 2033486 A1	18-02-1971
			NL 7010147 A	12-01-1971