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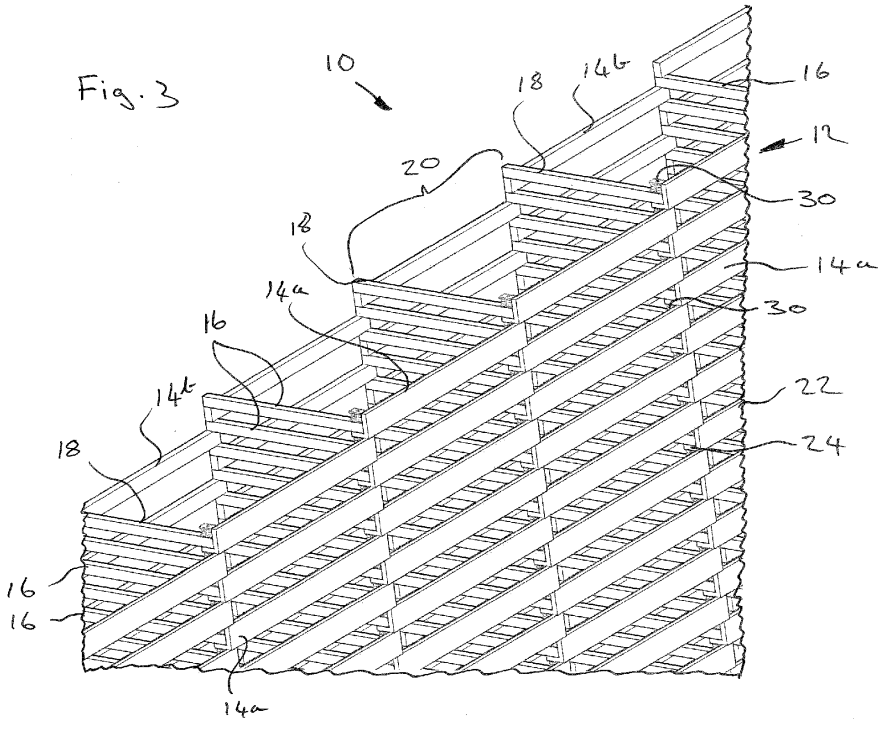
(54) **CRIB WALL STRUCTURE**

(57) A crib wall structure (12) includes a plurality of tiers of stretchers (14a, 14b) and headers (16) arranged for containing an in-fill material to form a crib wall. The stretchers (14a, 14b) are aligned longitudinally of the wall whilst the headers (16) are aligned perpendicular to the stretchers and arranged in a plurality of columns (18) spaced apart along the length of the wall. At the front face, front end stretchers (14a) span lengthways to interconnect front end regions of associated headers in adjacent columns in a tier. In an embodiment, the front end stretchers (14a) have a generally upright portion (22) and at least one rearward directed portion (24) and may be substantially 'L' shaped. The stretchers and headers may be extruded from recycled plastics and interconnected by means of pins. The front end stretchers (14a) may be arranged in a 'checkerboard' pattern with the front end stretchers in adjacent wall sections being off-set.

Fig. 3



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Description

Technical Field of the Invention

[0001] The present invention relates to crib walls and to methods and components for forming crib walls.

Background to the Invention

[0002] A crib wall is a well-established type of gravity retaining wall used widely throughout the world in construction. The primary components of a crib wall are stretchers and headers which are arranged in tiers and interconnected to form a skeletal crib structure for containing an in-fill material such as crushed stone, sand or gravel. The stretchers are elongate members which are aligned generally parallel to the face of the wall whilst the headers are elongate members aligned generally normal to the face of the wall and hence perpendicular to the stretchers. Stretchers are generally located along both the front and rear faces of the wall interconnected by headers.

[0003] Timber and pre-cast concrete have been frequently used in the manufacture of headers and stretchers for crib walls. The properties of the materials currently used vary significantly and these properties must be taken into consideration when designing the components of the wall for efficient manufacture, avoiding waste and minimising manufacturing processes, whilst maintaining performance criteria.

[0004] WO 01/57323 A1 describes a known crib wall 1 for retaining a bank as shown in figures 1 and 2. The crib wall 1 is supported on a suitable foundation, which may be made from concrete or the like. The wall 1 has a skeletal crib wall structure formed by interlocking stretchers 4 and headers 5. A granular fill material 6 is retained inside the skeletal structure to provide the necessary stabilising mass to the wall. In the wall of figures 1 and 2, the primary components are made from timber and the headers 5 have notches 7 in their upper and lower surfaces at front and rear ends in which the stretchers 4 locate. Whilst this provides a strong structure suitable for manufacturing from timber components, the arrangement requires the headers 5 to extend beyond the stretchers 4 to both the front and rear. This reduces the effective depth of the wall in comparison to the length of the headers. The notches 7 also reduce the height of each course by two times the depth of the notches. Both of these limitations reduce the efficient use of material in the primary components 4, 5. A further drawback with the known crib wall structure is that the front ends of the headers are exposed. Since the headers are typically formed from swan timber, this may not be aesthetically pleasing and may require the ends to be painted or stained. Also, since the front ends of the headers project beyond the front stretchers, the front face of the wall is not smooth.

[0005] It is an objective of the present invention to provide an alternative crib wall structure which overcomes, or mitigates some or all of the drawbacks of known crib wall structures.

[0006] It is a further objective of the present invention to provide a crib wall structure in which at least some of the primary components are made using polymeric materials, especially recycled plastics.

Summary of the Invention

[0007] According to a first aspect of the invention, there is provided a crib wall structure comprising:

a. a plurality of tiers of stretchers and headers arranged for containing an in-fill material to form a crib wall;

b. the stretchers comprising elongate members aligned generally along the length of the wall and the headers comprising elongate members aligned generally perpendicular to the stretchers, the stretchers and headers being initially separate members connected together to form the crib wall structure;

c. the headers being arranged in a plurality of columns spaced apart along the length of the wall, each adjacent pair of columns of headers defining a section of the wall, and each header having a front end at a front face of the wall and an opposite rear end;

d. the stretchers comprising front end stretchers, each front end stretcher spanning lengthways to interconnect front end regions of associated headers in adjacent columns in a tier;

characterised in the front end stretchers each have a generally upwardly directed portion and at least one rearward directed portion when viewed in lateral cross section.

[0008] The front end stretchers may be substantially 'L' shaped, or substantially 'C' shaped, or substantially 'U' shaped or substantially 'T' shaped.

[0009] The front end stretchers may be substantially 'L' shaped in lateral cross section, having a generally upright portion and a rearward directed portion.

[0010] In one embodiment, each front end stretcher is located with said at least one rearward directed portion in engagement with lower faces of said associated headers, the generally upwardly directed portion extending in front of the front ends of said associated headers.

[0011] In another embodiment, each front end stretcher is located with said at least one rearward directed portion in engagement with the upper faces of said associated headers, the generally upwardly directed portion extending upwardly toward the tier of headers above. In this embodiment, the outer faces of the generally upwardly directed portions of the front end stretchers may be substantially flush with front end faces of the headers.

[0012] Each front end stretcher may have a length substantially equal to the spacing between outer side edges of the headers in adjacent columns.

[0013] In an embodiment, in any given section of the wall structure, a respective front end stretcher interconnects associated headers in every other tier of headers only, the front end stretchers in any one section being off-set by a tier from the front end stretchers in any adjacent section.

[0014] In an embodiment, in any given tier of stretchers, the front end stretchers are spaced apart such that a front end stretcher extends between the adjacent headers defining every other section only, the front end stretchers in any one section being off-set by a tier from the front end stretchers in any adjacent section.

[0015] The crib wall structure may comprise spacer blocks positioned between at least some of the headers and a rearward directed portion of a front end stretcher.

[0016] The crib wall structure may also have rear end stretchers, each rear end stretcher extending between headers in adjacent columns. In an embodiment each rear wall stretcher rests on the upper surface of associated headers in the tier below and engages the lower surface of the headers in the tier above. Where the crib wall structure includes spacer blocks, the rear end stretchers may each have a height which is equal to the combined height of a rearward directed portion of a front end stretcher and a spacer block.

[0017] The stretchers may be interconnected with associated headers by pins which engage in corresponding pin receiving apertures in the headers and stretchers. In which case, each front end stretcher may be interconnected with each associated header by pin engaging in corresponding apertures in a rearward directed portion of the front end stretcher and said associated header. Where the wall structure includes spacer blocks, the front end stretchers may be interconnected with their associated headers by means of pin blocks, each comprising a spacer block portion which supports a header in a tier above and an integral pin portion. In an embodiment, each pin block is located with the spacer block between a rearward portion of a respective front end stretcher and a header in the tier below, the pin portion projecting downwardly through an aperture in said header in the tier below and into a corresponding aperture in a rearward directed portion of a further front end stretcher.

[0018] At least in the front end stretchers, the pin receiving apertures may be elongate in the longitudinal direction of the wall so as to enable the stretchers to slide in a longitudinal direction at least to a limited extent.

[0019] In an embodiment, the crib wall structure has first and second regions extending in different longitudinal directions and which meet to define an internal corner at the front face of the wall at their junction, wherein an end most section of each of the wall regions at the junction extends beyond the front face of the other wall region, the front end stretchers of the two end most sections being off-set from one another, with the front end stretchers of the two end most sections being interleaved and extending into the interior volume of the wall structure.

[0020] The stretchers and/or headers may include one or more polymeric materials which may be recycled polymeric materials.

[0021] According to a second aspect of the invention, there is provided a crib wall structure comprising:

a. a plurality of tiers of stretchers and headers arranged for containing an in-fill material to form a crib wall;

b. the stretchers comprising elongate members aligned generally along the length of the wall and the headers comprising elongate members aligned generally perpendicular to the stretchers, the stretchers and headers being initially separate members connected together to form the crib wall structure;

characterised in that the stretchers and headers are made of polymeric materials and are interconnected by pins which engage in corresponding pin receiving apertures in the headers and stretchers. The stretchers and headers may be made from recycled plastic.

[0022] The crib wall structure according to the second aspect of the invention may have any of the features of the crib wall structure according to the first aspect of the invention.

[0023] According to a third aspect of the invention, there is provided a crib wall structure comprising:

a. a plurality of tiers of stretchers and headers arranged for containing an in-fill material to form a crib wall;

b. the stretchers comprising elongate members aligned generally along the length of the wall and the headers comprising elongate members aligned generally perpendicular to the stretchers, the stretchers and headers being initially separate members connected together to form the crib wall structure;

c. the headers being arranged in a plurality of columns spaced apart along the length of the wall, each adjacent pair of columns of headers defining a section of the wall, and each header having a front end at a front face of the wall and an opposite rear end;

d. the stretchers comprising front end stretchers, each front end stretcher spanning lengthways to interconnect front end regions of associated headers in adjacent columns in a tier;

characterised in any given section of the wall, a respective front end stretcher interconnects associated headers in every other tier of headers only, the front end stretchers in any one section being off-set by a tier from the front end stretchers in any adjacent section.

[0024] The crib wall structure according to the third aspect of the invention may have any of the features of the crib wall structure in according to the first aspect of the invention.

[0025] According to a fourth aspect of the invention, there is provided a crib wall structure comprising:

a. a plurality of tiers of stretchers and headers arranged for containing an in-fill material to form a crib wall;

b. the stretchers comprising elongate members aligned generally along the length of the wall and the headers comprising elongate members aligned generally perpendicular to the stretchers, the stretchers and headers being initially separate members connected together to form the crib wall structure;

c. the headers being arranged in a plurality of columns spaced apart along the length of the wall, each adjacent pair of columns of headers defining a section of the wall, and each header having a front end at a front face of the wall and an opposite rear end;

d. the stretchers comprising front end stretchers, each front end stretcher spanning lengthways to interconnect front end regions of associated headers in adjacent columns in a tier;

characterised the front end stretchers extend in front of the front ends of the associated headers.

[0026] Positioning the front end stretchers so as to extend in front of the front ends of the heads means that the ends of the headers are not visible in the front face of the wall.

[0027] The crib wall structure according to the fourth aspect of the invention may have any of the features of the crib wall structure in according to the first aspect of the invention.

[0028] According to a fifth aspect of the invention there is provided an integral pin block for forming a crib wall, the pin block comprising a spacer block portion and pin portion projecting from a first face of the spacer block portion. The spacer block may define a bore in a second face opposite the first face for receiving the pin of another similar pin block. The bore and the pin may be aligned along a common axis.

Detailed Description of the Invention

[0029] In order that the invention may be more clearly understood embodiments thereof will now be described, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 is a perspective view from the front of a known crib wall structure;

Figure 2 is a cross sectional view through the crib wall structure of figure 1 illustrating how the stretchers and headers are interconnected;

Figure 3 is a perspective view of part of a crib wall structure in accordance with a first embodiment of an aspect of the invention;

Figure 4 is a lateral cross sectional view through the crib wall structure of figure 3;

Figure 5 is a perspective view on an enlarged scale of a pin block which forms part of the crib wall structure of figures 3 and 4;

Figure 6 is a front elevation of part of a crib wall formed using the crib wall structure of figures 3 and 4;

Figure 7 is a perspective view of an end region of the crib structure of Figures 3 and 4;

Figure 8 is a view similar to that of Figure 7 but illustrating an alternative method of constructing the end of the crib structure;

Figure 9 is a perspective of part of a crib wall structure in accordance with a second embodiment of an aspect of the invention; and

Figure 10 is a view from above of a crib wall structure in accordance with an aspect of the invention illustrating the formation of an internal corner in the front face of the wall.

[0030] A first embodiment of a crib wall structure 10 in accordance with an aspect of the invention will be described with reference initially to figures 3 to 8.

[0031] When used in reference to the wall 10 itself, the term "longitudinal" and the like should be understood do as referring to the lengthways direction of the wall generally parallel to the front face of the wall and the term "lateral" and the like will be used to refer to a direction from the front to the rear of the wall.

[0032] The crib wall 10 has a skeletal crib wall structure 12 formed by interconnected stretchers 14a, 14b and headers 16. The stretchers 14a, 14b are elongate members which are aligned longitudinally, generally parallel to the face of the wall (that is to say along the length of the wall) whilst the headers 16 are elongate members aligned laterally, generally normal to the front face of the wall and hence perpendicular to the stretchers 14.

[0033] The stretchers 14a, 14b and headers 16 can be manufactured from any suitable materials. In the present embodiment, they are manufactured from polymeric/plastics materials and can advantageously be manufactured from recycled plastics. The crib wall structure 10 is designed for efficient manufacture of the primary

components, avoiding waste and minimising manufacturing processes, whilst maintaining performance criteria taking into account mechanical properties of suitable recycled plastics materials.

[0034] Figures 3 and 4 show the skeletal crib structure 12 of the wall 10 without the fill material for clarity. The headers 16 are elongate members having a generally constant rectangular or square cross section. The headers 16 are arranged in columns 18 spaced along the length of the wall 10. Each pair of adjacent columns 18 can be said to define a section 20 of the wall 10, each section extending between the outer side faces of the headers in the adjacent columns. It will be appreciated that adjacent sections 20 of the wall overlap to an extent as each pair of adjacent wall sections share a common column 18 of headers 16.

[0035] Stretchers 14a, 14b are provided along the both the front and rear faces of the wall 10. The stretchers along the front face will be referred to as front end stretchers 14a, whilst those along the rear face will be referred to as rear end stretchers 14b. The front end stretchers are elongate members have a substantially constant 'L' shape in lateral cross-section, having a generally upright portion 22 which locates at the front face of the wall and a rearward directed portion 24 with projects into the wall, the two portions arranged substantially at 90 degrees to one another. The rear end stretchers 14b have a substantially constant rectangular shape in cross section but could alternatively be square in cross section. Both the front and rear end stretchers 14a, 14b have a length substantially equal to the distance between the outer side edges of the headers 16 in adjacent columns 18 so that each stretcher 14a, 14b interconnects the headers 16 in adjacent columns 18 in a given tier of headers and extends for the length of one section 20 of the wall. The headers 16 interconnected by any given stretcher 14a, 14b will be referred to as "associated headers".

[0036] In the crib wall structure 12 of the first embodiment, the front end stretchers 14a are arranged with the upper surface 26 of the rearward directed portion 24 in contact with the lower surfaces 28 of the associated headers 16 and with the upright portion 22 extending upwardly in front of the front ends of said associated headers. In this arrangement, the upright portion 22 of the front end stretchers 14a completely covers the front ends of their associated headers 16. In view of this, for any given tier of headers 16, a front end stretcher 14a is only provided in every alternate section 20 of the wall. Furthermore, in any one section 20 of the wall 10, a front end stretcher 14a is only provided for every other tier of headers, with the front end stretchers 14a in adjacent sections 20 being off-set from one another by a tier. As illustrated in figures 3 and 6, the front end stretchers in this arrangement are arranged in what can be described as a "checkerboard" pattern. As indicated in Figure 6, fill material 6 is introduced inside the crib structure.

[0037] Each rear end stretcher 14a also extends between the headers in adjacent columns 18 in a given tier. Each rear end stretcher 14b sits on top of a first pair of associated headers 16 in a tier below whilst corresponding associated headers in the tier above are supported on the upper surface of the rear end stretcher. As with the front end stretchers 14a, the rear end stretchers are arranged in a checkerboard pattern with the rear end stretchers 14b in any given tier being spaced apart such that a rear end stretcher 14b is provided in every other section 20 only and with the rear end stretchers 14b in adjacent wall sections 20 being offset from one another by a tier. Typically, in any given section of the wall, the front end stretchers 14a and the rear end stretchers 14b are off-set by a tier from one another.

[0038] The rear end stretchers have a height x which is greater than the height y of the rearward directed portions 24 of the front end stretchers and spacer blocks 30 are used at the front end of the wall to make up for the difference in height. Spacer blocks 30 are located between the rearward directed portion 24 of each front end stretcher and the headers 16 in an adjacent tier. In the embodiment of figure 3 and 4, each spacer block locates between the rearward directed portion 24 of the front end stretcher 14a and the header in a tier below. However, other arrangements are possible.

[0039] The upright portion 22 of the front end stretchers 14a has a height z, measured at the outer front face, which is equal to the combined heights of the rearward directed portion 24, a header 16, and a spacer block 30 such that in the assembled wall structure 12, the upper end surfaces 32 of the upright portions 22 are co-planar with the upper surfaces 33 of their respective spacer blocks 30. The crib wall structure 12 is configured so that with the exception of the front end stretchers 14a in the lowermost tier which are supported on the foundation, each front end stretcher 14a is supported from below at either end on the upper surface of a spacer block 30 sitting on the header in the tier below and a front end stretcher in an adjacent section of the wall in the tier below.

[0040] The stretchers 14a, 14b and headers 16 are interconnected by means of pins 34, 36 which engage in corresponding apertures in the stretchers 14a, 14b and headers 16. At the rear of the wall, a pin 34 extends through an aperture 38 at the rear end of each header 16 and engages in corresponding apertures 40 in the rear end stretchers 14b both above and below the respective header. The corresponding apertures 40 in the rear end stretchers 14b may be blind bores or through bores.

[0041] At the front end of the wall structure 12, a pin 36 is used at either end of each front end stretcher 14a to interconnect the rearward directed portion 24 of the stretcher 14a to its associated header 16 and respective spacer blocks 30 above and below the rearward directed portion 24 and the associated header 16. Conveniently, the spacer block 30 and pin 36 are formed as integral pin block 42. As illustrated in figure 5, each pin block 42 comprises a spacer block portion 30 with a pin portion 36

projecting from, in this case, a lower surface of the spacer block portion 30. An aperture 44 for receiving the pin 36 of another pin block is formed in the upper surface of the spacer block. The pin blocks 42 may be manufactured from any suitable material but in an embodiment are manufactured from polymeric materials such as glass reinforced plastic. As illustrated in figure 4, each bin block 42 is located with the spacer block portion 30 sitting on top of a header 16 to support the front end stretcher/header above with the pin portion 36 extending downwardly through corresponding apertures 46, 48 in the header and the rearward directed portion 24 of the front end stretcher below respectively and engaging in the pin receiving aperture 44 in the spacer block 30 below. This ties the spacer block portion 30 to the header 16, the front end stretcher 14a and the spacer block 30 below, preventing unwanted relative movement between them in both lateral and longitudinal directions. In the completed crib structure, all the headers 16 in a given column 18 are interconnected together with the associated front end stretchers by the pin blocks.

[0042] The use of pin blocks 42 with an integral spacer 30 and pin 36 reduces the number of separate components required to form the wall and so helps reduce the cost of materials handling and simplifies assembly. However, it will be appreciated that separate spacer blocks 30 and connection pins 36 could be used.

[0043] Where stretchers 14a, 14b are only provided in every other wall section 20, the pin connection can be adapted to allow for longitudinal expansion of the stretchers by elongating the pin holes 48 in the stretchers in the longitudinal direction of the wall. This allows each stretcher to slide longitudinally between the stretchers above and below as it expands. This is particularly advantageous for front end stretchers 14a which are exposed to sunlight.

[0044] In the majority of crib wall structures, the wall does not have any significant height at its ends which need to be supported, as typically the height of the bank supported by the wall tapers at its ends and either the top or bottom, or both, of the wall is stepped down gradually to the ends. Alternatively, the wall may butt up against another structure which will support the end of the wall. However, in some cases the crib wall have a significant height. Figures 7 and 8 illustrate two possible arrangements for forming an end of the crib structure 12.

[0045] Figure 7 illustrates an arrangement suitable for use where an end of the crib wall 10 is self-supporting and will be visible. In this embodiment, 'L' section stretchers are used as additional headers 16a in alternate courses between the front end stretchers 14a at the end of the wall. A similar arrangement can be used where the wall steps down from one section to the next to support the exposed higher tiers in the taller section. Figure 7 also illustrates the use of elongate cover plates 50 positioned along the upper surfaces of the topmost front end stretchers 14a in each section of the wall. The cover plates 50 are provided for aesthetic reasons to cover the upper surfaces of the front stretchers and the spacer blocks below. The cover plates 50 may be made from the same material as the front end stretchers 14a and can be secured in position by any suitable means. The cover plates 50 could, for example, be adhesively secured in position and would only be required above ground. In addition to the elongate cover plates, end caps 52 can be used to cover exposed ends of the 'L' section front end stretchers 14a and additional headers 16a. The end caps 52 may also be made of the same material as the front end stretchers and may be attached by any suitable means, including adhesive.

[0046] Figure 8 illustrates an alternative end structure which may be suitable where the end of the crib wall will not be visible. The construction is similar to that described above with respect to Figure 7, except that rather than using 'L' shaped headers, deeper section rectangular headers 16b are used between the front and rear end stretchers. This may be advantageous in providing a lower cost construction compared to the arrangement in Figure 7. As with the embodiment in Figure 7, elongate cover plates 50 can be used along the upper surface of the topmost front end stretcher in each wall section. In this embodiment end caps 54 are only used to cover the outer ends of the deeper section headers at the front face of the wall.

[0047] Figure 9 illustrates an alternative embodiment of a crib wall structure 112 in accordance with the invention. The same reference numerals but increased by 100 in each case will be used to identify features in common with the previous embodiment.

[0048] In this embodiment, the upright portions 122 of the front end stretchers 114a have a height which is equal to the height of the rear end stretchers 114b. The front end stretchers 114a are located with the rearward directed portions 124 sitting on top of headers 116 below whilst headers 116 in the tier above are supported on the upper end of the upward portions. In this embodiment, no spacer blocks are required.

[0049] The front end stretchers 114a are interconnected with the associated headers 116 by means of pins (not shown) which each extend through an aperture a respective header 116 into corresponding apertures in the stretchers 114a above and below, in a manner similar to the rear stretchers as described in relation to the first embodiment. However, other arrangements for interconnecting the stretchers and headers can be adopted.

[0050] The crib wall structure 112 in this second embodiment is otherwise constructed in a manner similar to that of the first embodiment 12 as described above and to which the reader should refer for details.

[0051] Figure 10 illustrates the formation of a corner in a crib wall 10 which can be produced using a crib wall structure in accordance with either of the embodiments 12, 112 described above. However, for convenience, the formation of the corner structure will be described with reference to the first embodiment 12 only.

[0052] The crib wall 10 as shown in figure 10 has two

wall regions 10a, 10b extending in different longitudinal directions and which meet at an acute or obtuse angle to form an internal corner in the front face of the wall. In the example shown, the wall regions extend at 90 degrees to one another but this is not essential.

[0053] The adjoining sections 20a, 20b of each wall region which meet at the junction are overlapped so that the endmost column of headers 18a in the first wall region 10a is positioned internally beyond the front face of the second wall section 20b and the endmost column of headers 18b in the second wall region 10b is positioned internally beyond the front face of the first wall section 20a. The wall structure 12 is configured so that the front end stretchers 14a in the overlapped wall sections 20a, 20b are offset from one another by a tier, enabling the front end stretchers 14a in the two sections to be interleaved to extend inside the wall structure at the junction. This eliminates the need to cut the front end stretchers to length and produces a very neat professional looking corner formation in the crib wall with minimal skill. Overlapping the stretchers 14a in an internal corner also improves rigidity of the wall structure.

[0054] A crib wall structure 12, 112 in accordance with the invention has many advantages, especially, but not exclusively, where the stretchers 14a, 14b, 114a, 114b and headers 16, 116 are made from polymeric materials, such as recycled plastics.

[0055] The stretchers 14a, 14b, 114a, 114b and headers 16, 16a, 16b, 116 are all elongate components of substantially constant cross section which lend themselves to manufacture from polymeric materials by extrusion with minimal waste. By interconnecting the stretchers and headers using pins, the only post extrusion machining required is to form the pin holes. This minimises waste and manufacturing procedures. The use of pin connections also avoids the need to produce notches in the headers thus avoiding the disadvantages of this arrangement.

[0056] The use of 'L' section front end stretchers having generally upwardly directed portion and at least one rearward directed potion offers several advantages:

- An 'L' section has a higher section modulus than a rectangular section of the same crosses sectional area. This allows the front end stretchers to be made with more slender sections for a given strength requirement thus reducing the amount of material required.
- An 'L' section front stretcher allows for the fill material to be securely retained by a shallow angle of repose between vertically adjacent stretchers. The slope of the front face of the wall contributes to the total angle of repose of the fill material. Improvements in the angle of repose provided by the 'L' shaped geometry of the front end stretchers allows for the possibility of the wall to be built closer to the vertical or vertical.

[0057] Whilst front end stretchers 14a, 114a which are generally 'L' shape in lateral cross section are particularly suitable, front end stretchers having alternative shapes in lateral cross section can also provide many of the above advantages provided they have a generally upwardly directed portion and at least one rearward directed portion or arm. For example, the front end stretchers 14a, 114a, could be substantially 'C' shaped, or substantially 'U' shaped or substantially 'T' shaped, in lateral cross section.

[0058] Having the upward portions 22 of the front end stretchers 14a extending in front of the ends of the headers as in the first embodiment is advantageous in hiding any 'end grain' of the headers, especially where these made of the extruded recycled plastic. Accordingly, no special measures, such as pigments, paint or other surface treatments are required to make the ends of the headers visually acceptable. However, even in the second embodiment where the end of the headers are exposed, the headers do not extend beyond the front face of the front end stretchers or the rear face of the rear end stretchers thus maximising the effective depth of the wall.

[0059] The 'checkerboard' arrangement of the font end stretchers also offers a number of advantages:

- As already discussed, the 'checkerboard' arrangement enables longitudinal expansion of the front end stretchers to be accommodated.
- Almost 50% of the face area is exposed fill material, much higher than with other arrangements, allowing for an increased density of planting/landscaping.
- Avoiding the protrusion of header nibs through the front face allows the wall to positioned closer to walkways and removes the risk of injury to people working or passing close by.
- The 'checkerboard' arrangement is visually more pleasing and more tolerant to minor variations in level along the wall length that continuous lines of stretchers tend to highlight.
- Corners can be constructed as discussed with reference to figure 10 with ends of the front end stretches extending inside the wall structure. This avoids the need for extensive on-site cutting of components which is both time consuming end expensive and requires a reduced skill lever to create a 'professional' looking corner.

[0060] The 'checkerboard' arrangement of the front end stretchers reduces the overall amount of material used in crib wall structure as does the 'checkerboard' arrangement of the rear end stretchers.

[0061] The above embodiments are described by way of example only. Many variations are possible without departing from the scope of the invention as defined in the appended claims.

Claims

1. A crib wall structure comprising:

   a. a plurality of tiers of stretchers and headers arranged for containing an in-fill material to form a crib wall;
   b. the stretchers comprising elongate members aligned generally along the length of the wall and the headers comprising elongate members aligned generally perpendicular to the stretchers, the stretchers and headers being initially separate members connected together to form the crib wall structure;
   c. the headers being arranged in a plurality of columns spaced apart along the length of the wall, each adjacent pair of columns of headers defining a section of the wall, and each header having a front end at a front face of the wall and an opposite rear end;
   d. the stretchers comprising front end stretchers, each front end stretcher spanning lengthways to interconnect front end regions of associated headers in adjacent columns in a tier;

   characterised in that, each front end stretcher has a generally upwardly directed portion and at least one rearward directed portion.

2. A crib wall structure as claimed in claim 1, wherein the front end stretchers are substantially 'L' shaped, or substantially 'C' shaped, or substantially 'U' shaped or substantially 'T' shaped.

3. A crib wall structure as claimed in claim 1 or claim 2, wherein the front end stretchers are generally 'L' shaped, having a generally upright portion and a rearward directed portion.

4. A crib wall structure as claimed in any one of the preceding claims, wherein each front end stretcher is located with said at least one rearward directed portion in engagement with lower faces of said associated headers, the generally upwardly directed portion extending in front of the front ends of said associated headers.

5. A crib wall structure as claimed in anyone of claims 1 to 3, wherein each front end stretcher is located with said at least one rearward directed portion in engagement with the upper faces of said associated headers, the generally upwardly directed portion extending upwardly toward the tier of headers above.

6. A crib wall structure as claimed in any one of the preceding claims, wherein in any given section of the wall structure, a respective front end stretcher interconnects associated headers in every other tier of headers only, the front end stretchers in any one section being off-set by a tier from the front end stretchers in any adjacent section.

7. A crib wall structure as claimed in any one of the preceding claims, wherein in any given tier of stretchers, the front end stretchers are spaced apart such that a front end stretcher extends between the adjacent headers defining every other section only, the front end stretchers in any one section being off-set by a tier from the front end stretchers in any adjacent section.

8. A crib wall structure as claimed in any one of the preceding claim, the wall structure comprising spacer blocks positioned between at least some of the headers and rearward directed portions of a front end stretcher.

9. A crib wall structure as claimed in any one of the preceding claims, the wall structure further comprising rear end stretchers, each rear end stretcher extending between headers in adjacent columns and wherein each rear wall stretcher rests on the upper surface of associated headers in the tier below and engages the lower surface of the headers in the tier above.

10. A crib wall structure as claimed in claim 9 when dependent on claim 8, wherein the rear end stretchers each have a height which is equal to the combined height of the at least one rearward directed portion of a front end stretcher and a spacer block.

11. A crib wall structure as claimed in any one of the preceding claims, wherein the stretchers are interconnected with associated headers by pins which engage in corresponding apertures in the headers and stretchers.

12. A crib wall structure as claimed in claim 11 when dependent on claim 8, wherein the front end stretchers are interconnected with their associated headers by means of pin blocks, each comprising a spacer block portion integral with a pin portion.

13. A crib wall structure as claimed in claim 12 when dependent on claim 4, wherein each pin block is located with the spacer block portion between a rearward directed portion of a respective front end stretcher and a header in the tier below, the pin portion projecting downwardly through an aperture in said header in the tier below and into a corresponding aperture in a rearward directed portion of a further front end stretcher.

14. A crib wall structure as claimed in any one of claims 11 to 13, wherein the pin apertures in at least the

front end stretchers are elongate in the longitudinal direction of the wall so as to enable the front end stretchers to slide in a longitudinal direction, at least to a limited extent.

15. A crib wall structure as claimed in any one of the preceding claims, wherein the stretchers and headers are made from one or more polymeric materials which may be recycled polymeric materials.

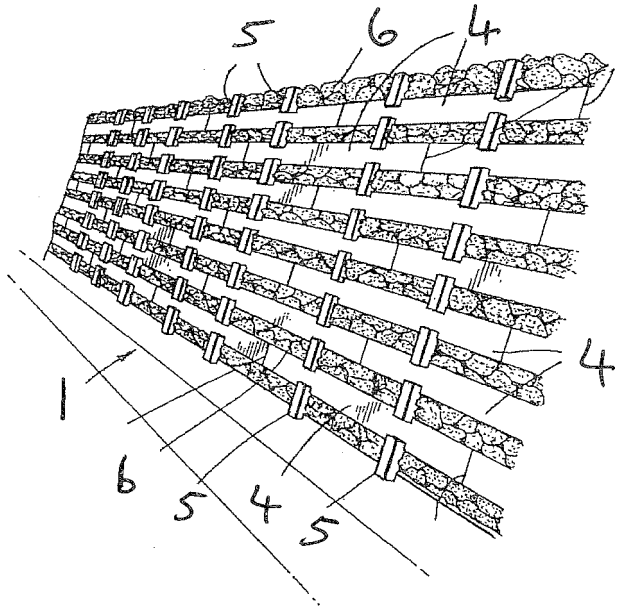

Fig. 1 (Prior Art)

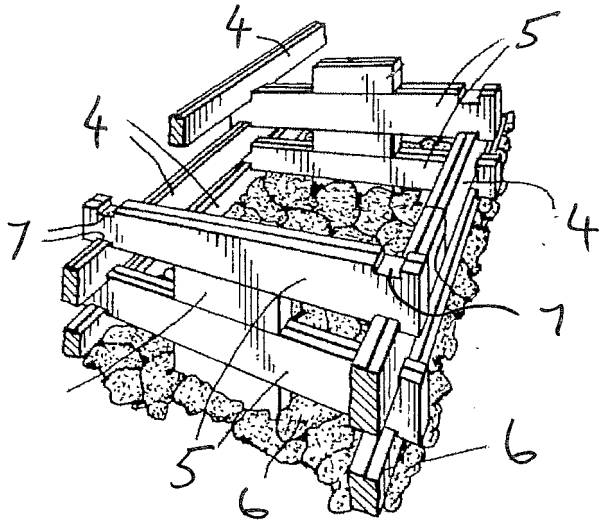

Fig. 2 (Prior Art)

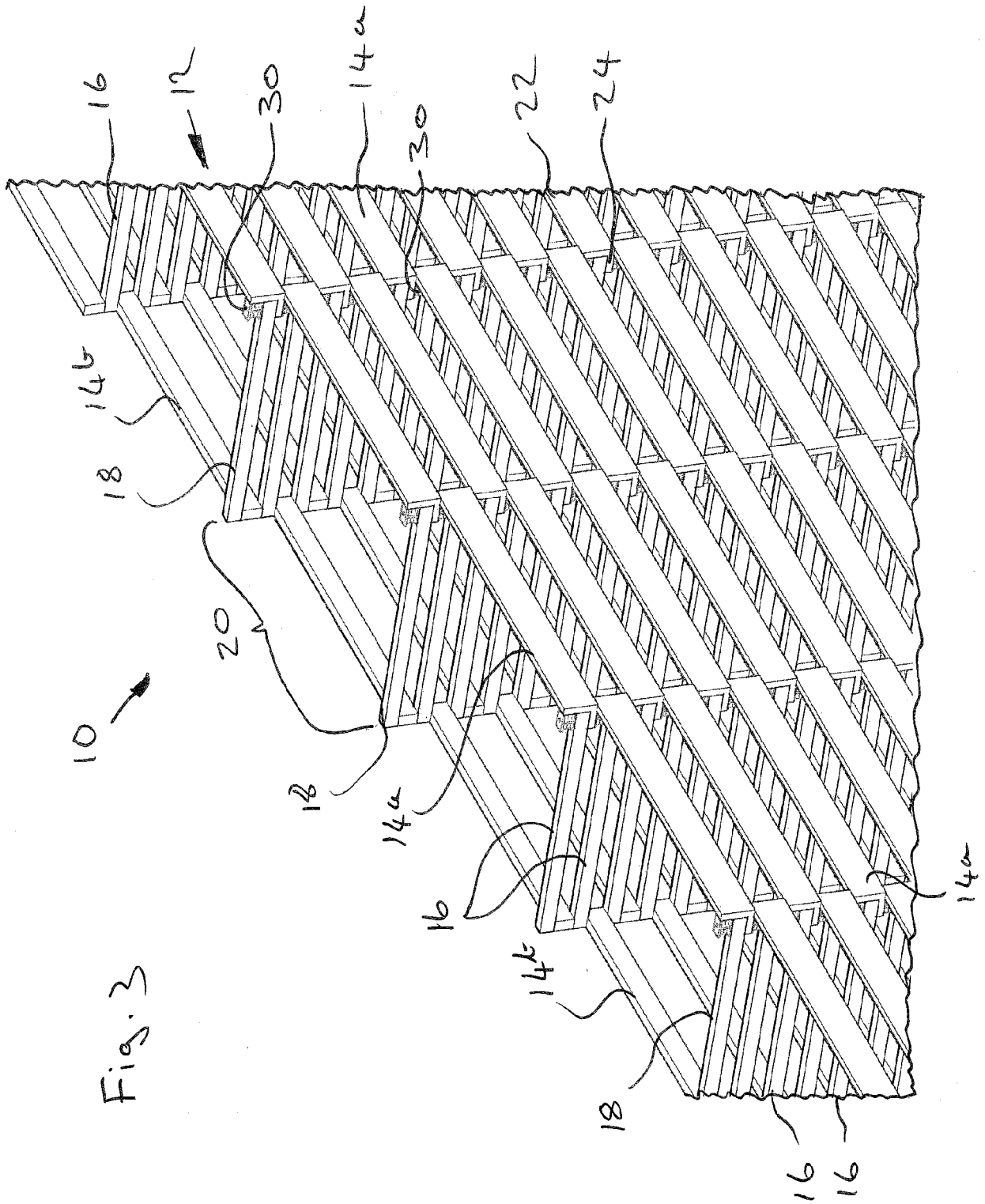

Fig. 3

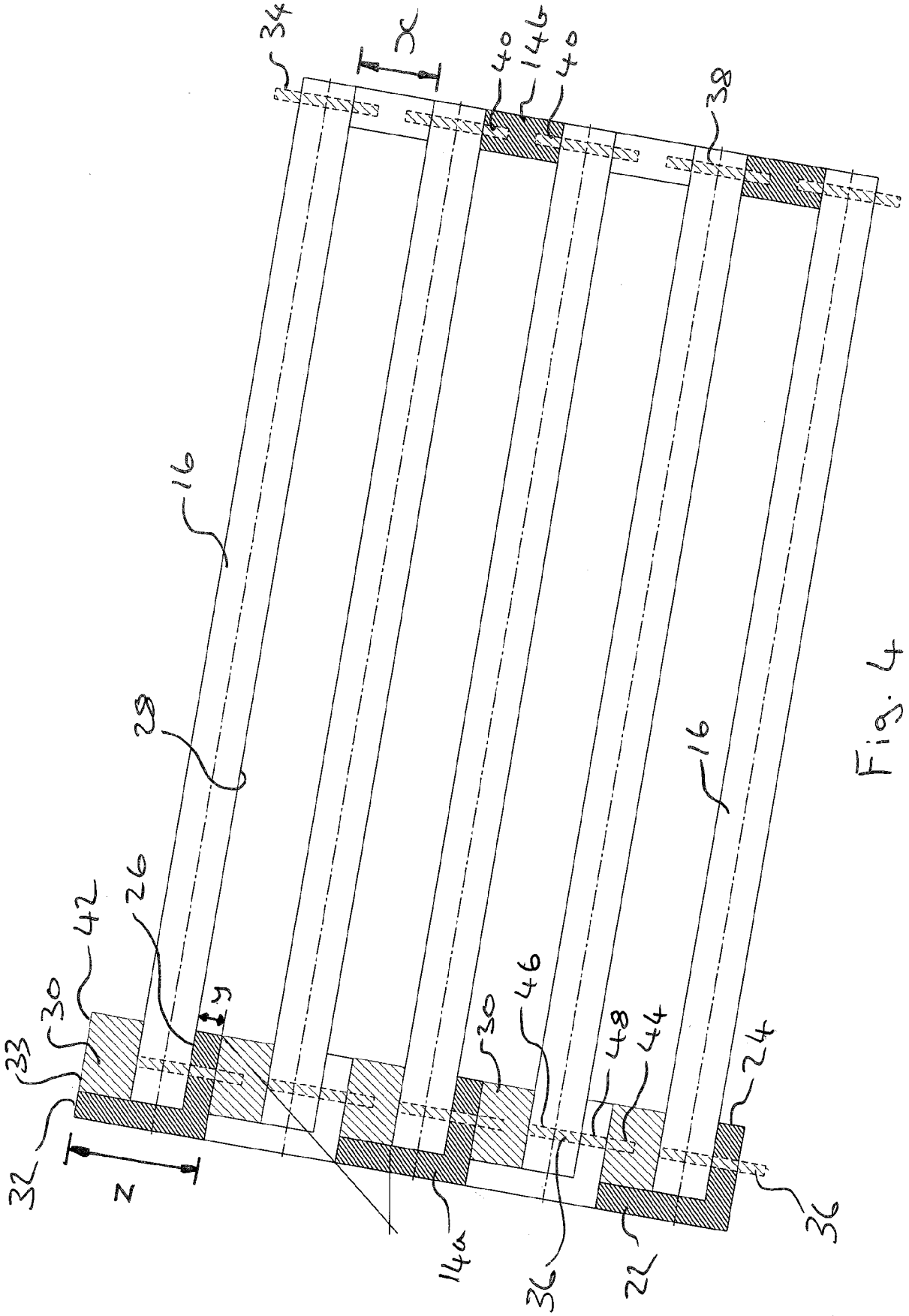

Fig. 4

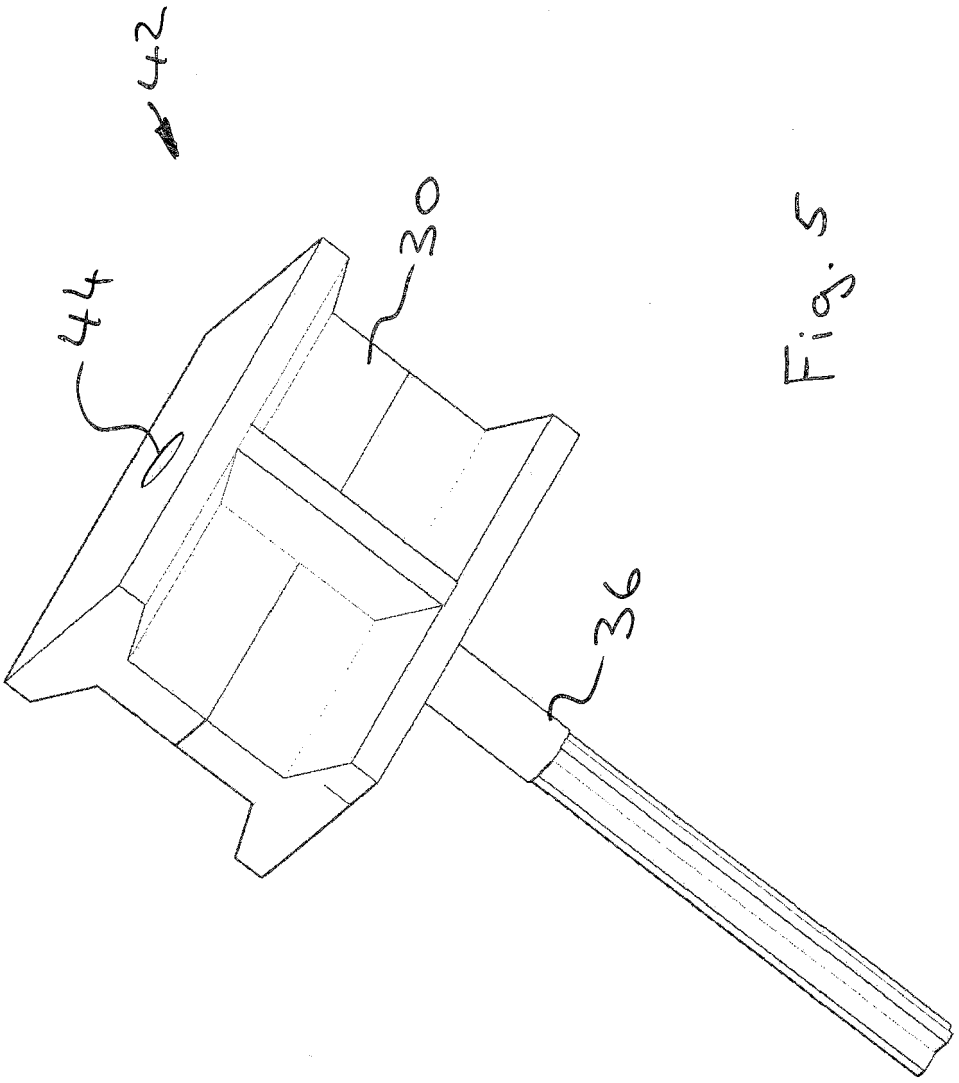

Fig. 5

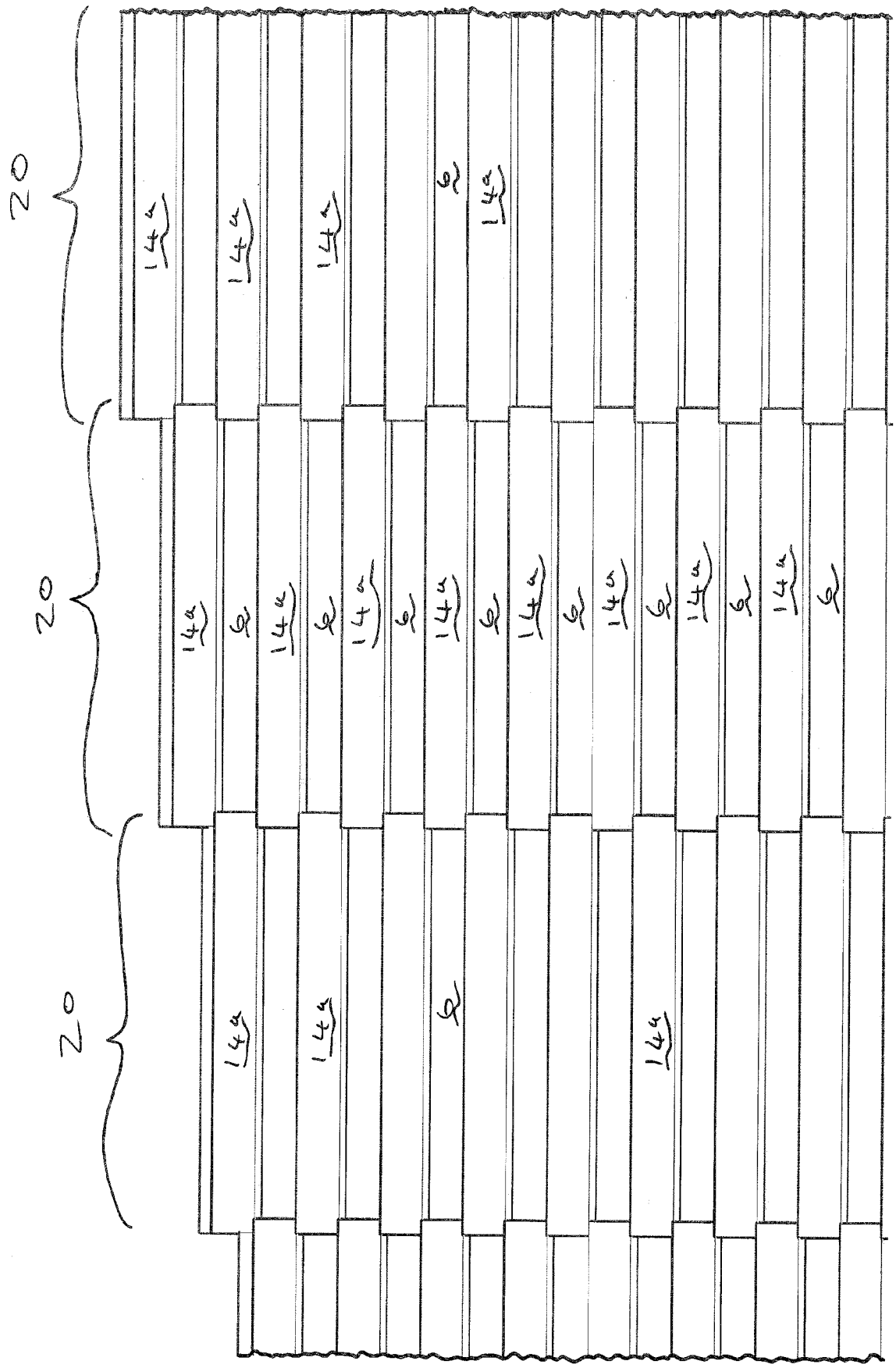

Fig. 6

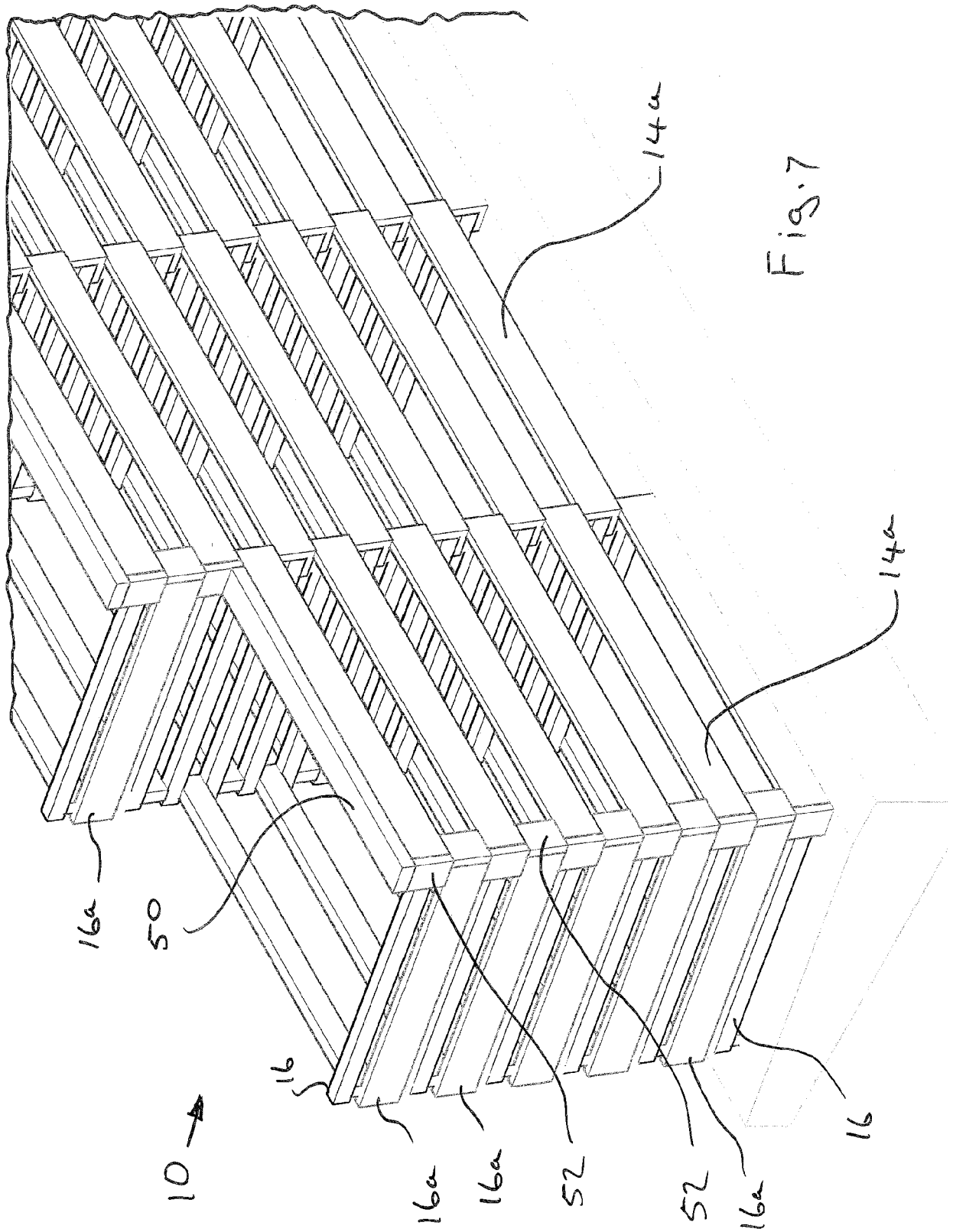

Fig. 7

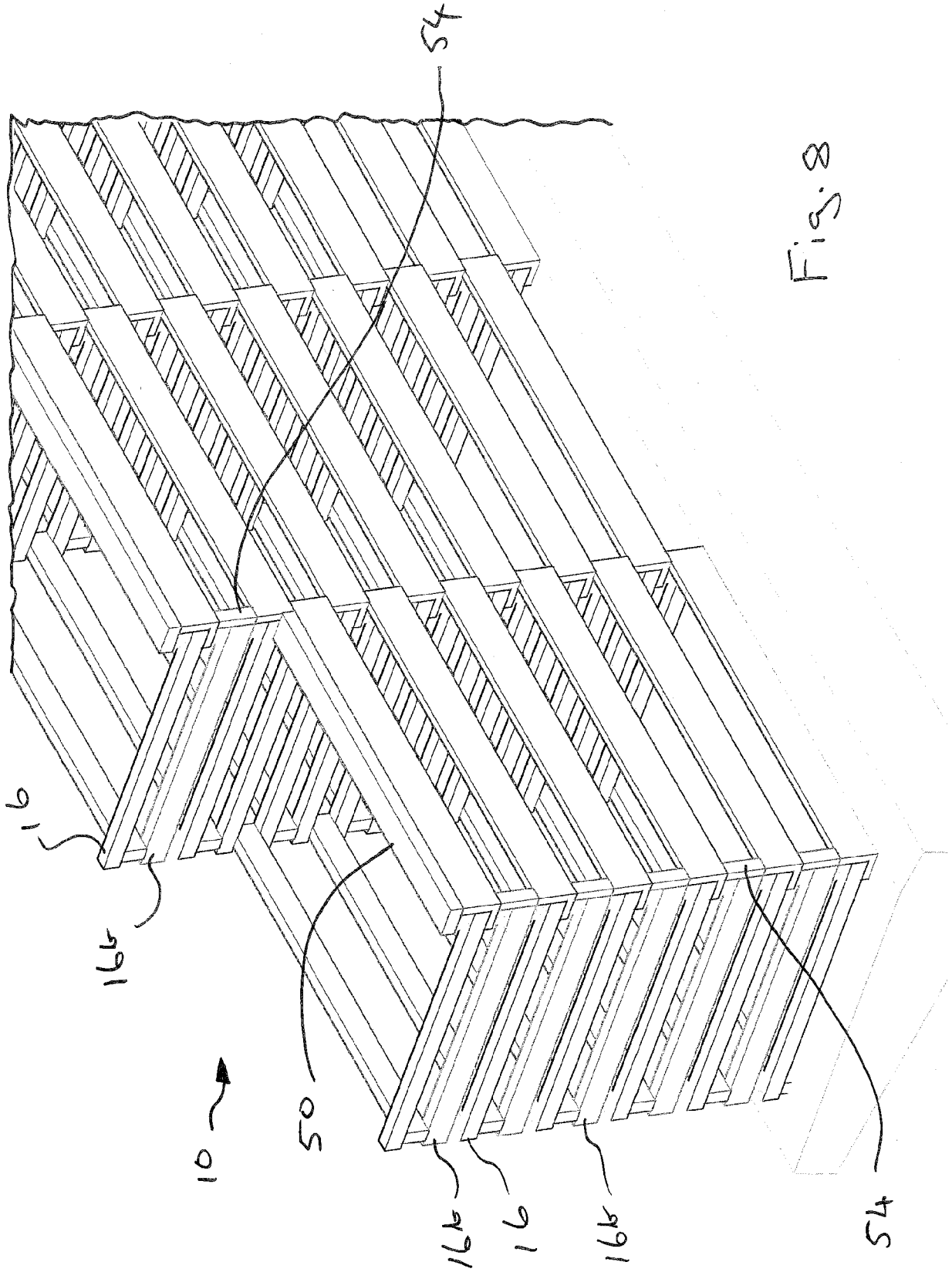

Fig. 8

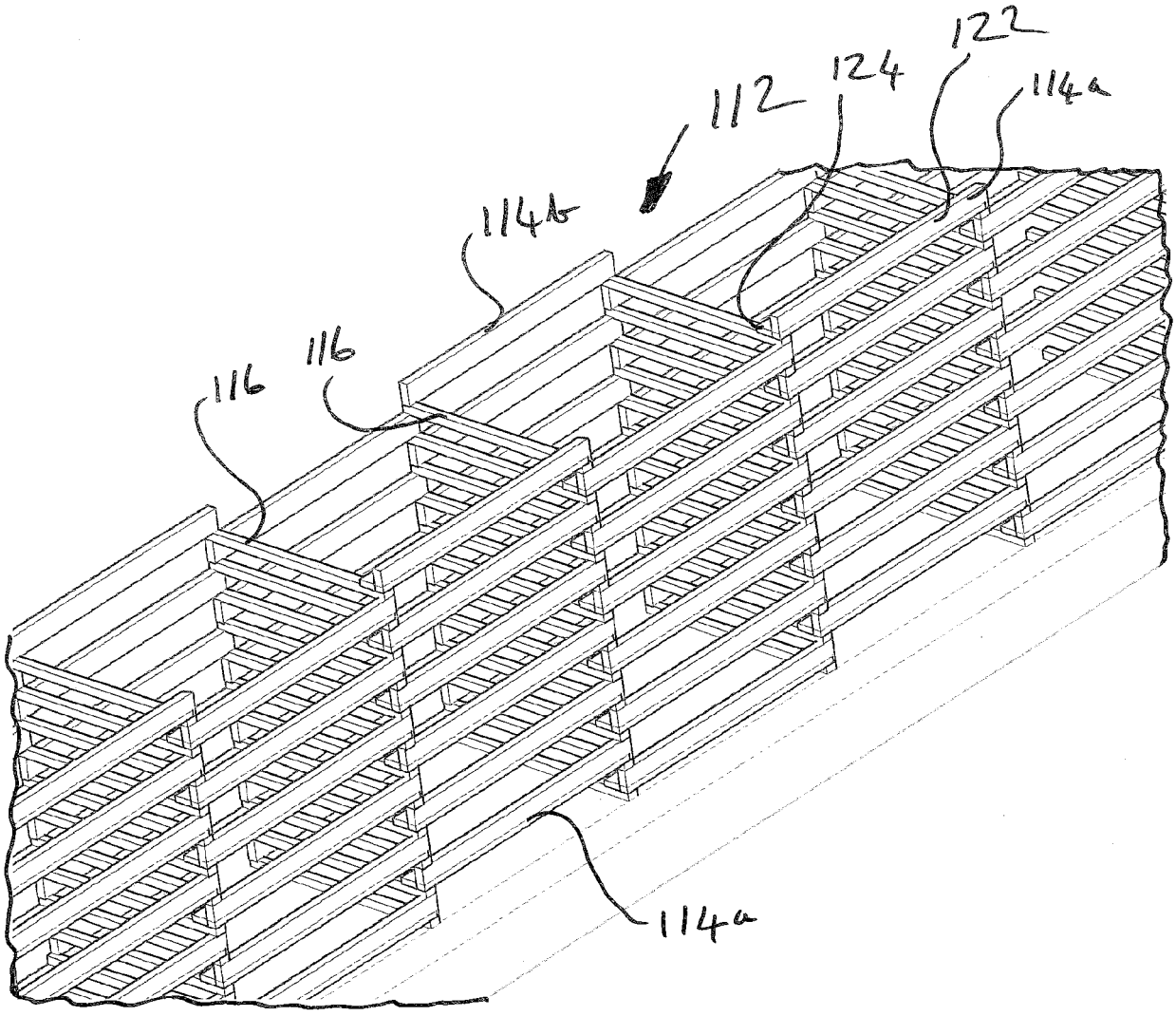

Fig. 9

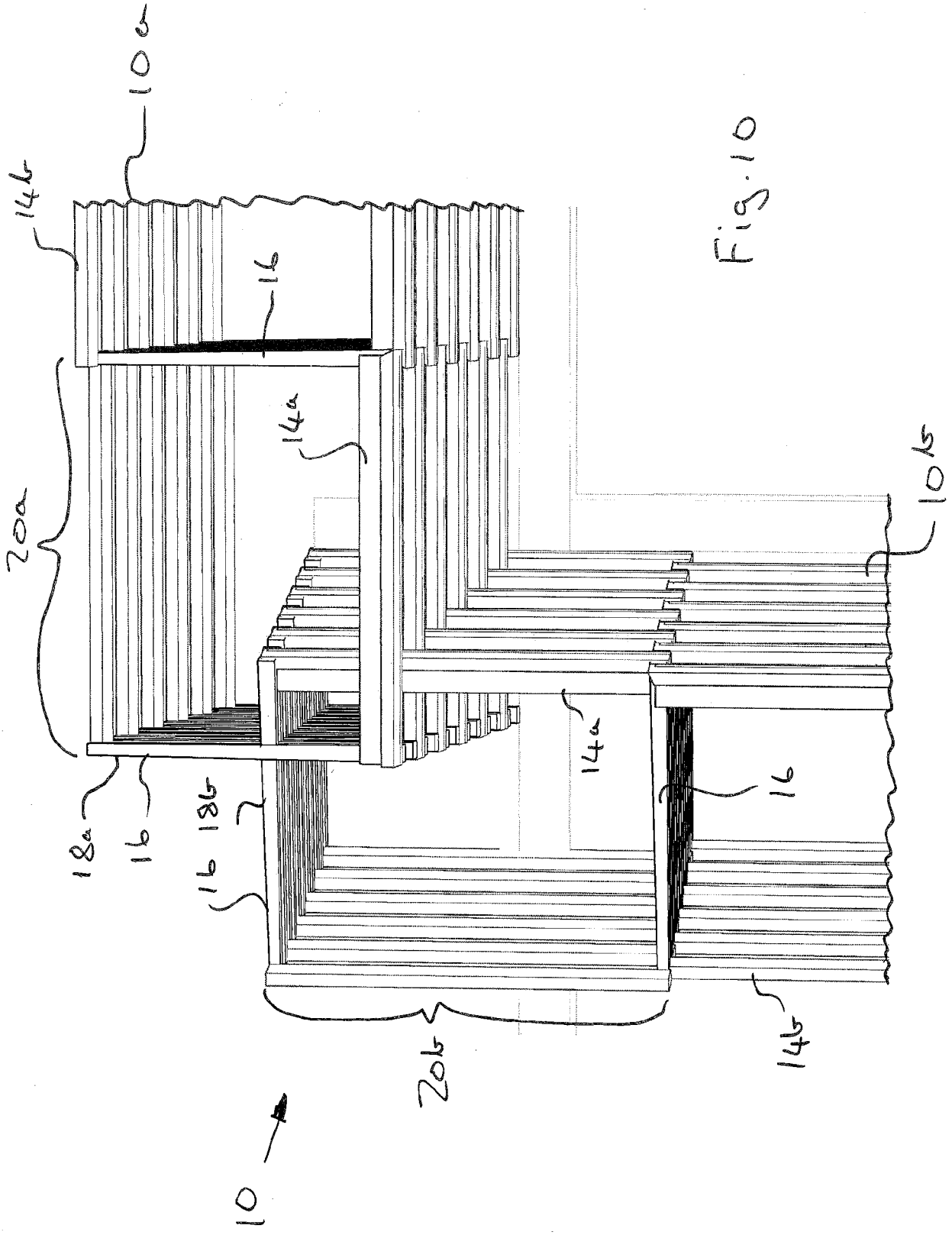

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 18 19 0414

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 October 2018	Geiger, Harald

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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