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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) Assembly elements with connection heads.

(57) An assembly element (1) comprising an elongated member (2) extending along an axis bearing, at at least one of its end, a connection head (4). The heads (4) comprise a fork (8) made out of two branches (10,12), the axis of each of the two branches making an angle of about 30° with respect to the axis of the fork(8), which corresponds with the axis of the elongated member (2). A first branch (10) bears at its free end a dovetail tenon (14), the proximal face of the first branch (10) forming, together with the second branch (12), a dovetail mortise (18) whose dimensions correspond to the dimensions of the dovetail tenon (14), so as to allow a sliding assembly of the connecting heads (4) of two assembly elements (1).

Fig 3a

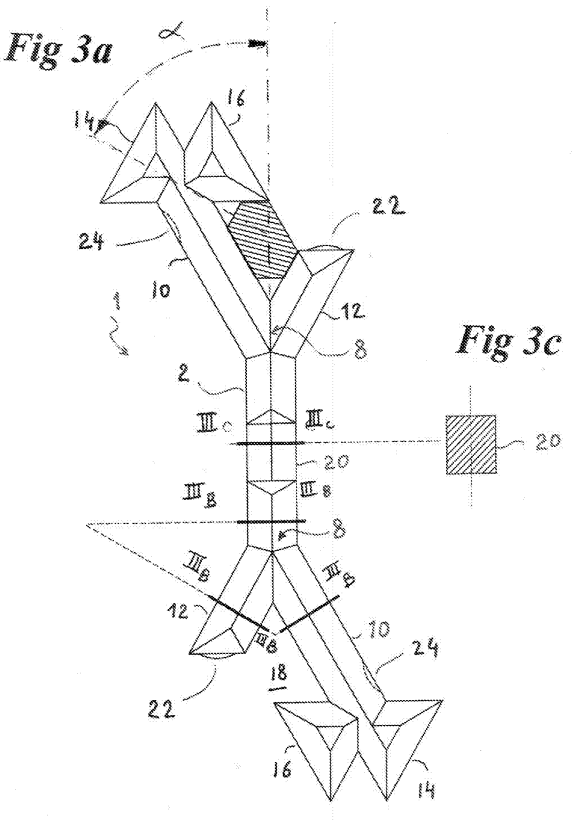

Fig 3c

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Description

[0001] The invention concerns interlocking assembly elements that can be used for various purposes, for example gardening, building, construction, decorative purposes, toys and so on.

Prior art

[0002] Many interlocking assembly elements have been developed for building various types of assemblies. Lego® type bricks allow the construction of solid toys or building. US 4,550,539 describes star-shaped mating interlocking panels allowing the assembly of ducts.

[0003] US 6,592,421 describes square elements provided with genderless connectors allowing the construction of 3-D toys.

[0004] None of the prior art does suggest elongated elements prolonged with keys ends for building structures that keep their stability whatsoever the scale, from toys to semi-permanent or even permanent building elements.

Summary of the invention

[0005] The object of the invention is precisely to provide elements that can be used to erect structures adaptable for toys as well as for plant-aids or building.

[0006] The subject of the invention is an assembly element characterized in that it comprises an elongated member extending along an axis bearing, at at least one of its end, a connecting head, said head comprising a fork made out of two branches, the axis of each of the two branches making an angle of about 30° with respect to the axis of the fork, which corresponds with the axis of the elongated member, a first branch bearing at its free end a dovetail tenon, the proximal face of the first branch forming, together with the second branch, a dovetail mortise whose dimensions correspond to the dimensions of the dovetail tenon, so as to allow a sliding assembly of the connecting heads of two assembly elements.

[0007] According to a preferred embodiment, the dovetail tenon and mortise have the form of isosceles trapeziums whose base angle is 60°.

[0008] According to a preferred embodiment, the medium axis of the tenon placed on the first branch makes an angle α of 60+(n x 30°) with the axis of the fork, the value of n being [0, 1, 2]

[0009] The dovetail mortise is preferably closed by an isosceles trapezium whose dimensions are similar to the dimensions of the dovetail tenon, so as to ensure the absence of voids at the junction of several assembly elements. Accordingly, if the value of angle α is 60, when assembled, six converging assembly elements evocate a David star.

[0010] The head and the elongated member advantageously extend in a plane, the elongated member comprising planar faces extending normal to this plane.

[0011] According to an advantageous embodiment, the elongated member has a hexagonal cross-section, two sides of the hexagon extending normal to the plane having a length corresponding to the width of the mouth of a head's mortise and being separated by a distance also corresponding to the width of the mouth of a head's mortise.

[0012] According to a preferred embodiment the elongated member of a first element comprises at least one part of cross-section allowing its connection with a connecting head of a second assembly element extending in another plane.

[0013] According to a preferred embodiment this elongated member of a first element comprises at least one segment of square cross-section, a side of this square having a length corresponding to the width of the mouth of a head's mortise, allowing the insertion of a connecting head of a second assembly element extending in another plane, normal to the plane of the first element. This is advantageous, because it is then possible, with the same elements, to build three-dimensional structures.

[0014] According to a particular embodiment, the elongated member comprises diverging strips for binding items to these elements. This will be useful e.g. for gardening assemblies.

[0015] Another subject of the invention is a first auxiliary assembly element to be used in conjunction with assembly elements as described above, which comprises, placed parallel to each other, two dovetail tenons allowing two reverted assembly elements to be connected lengthwise.

[0016] The dovetail tenons of this auxiliary assembly element are advantageously borne by two segments, placed sidewise, whose hexagonal cross-section corresponds to the hexagonal cross-section of the connected elongated members.

[0017] Another subject of the invention is a second auxiliary assembly element to be used in conjunction with assembly elements and first auxiliary assembly elements as described above. This second auxiliary assembly element has the shape of a head of an assembly element and serves to complete the locking of a plurality of converging assembly elements, the medium axis of the tenon placed on the first branch making an angle α of 60+ (n x 30 °) with the axis of the fork, the value of n being [0, 1, 2, 3, 4, 5 or 6].

[0018] To ensure a firm assembly of the above-described assembly element and first or second auxiliary assembly elements, the connecting head preferably comprises at least one locking device maintaining in place the connecting heads of two assembled elements.

Short description of the drawings

[0019] These and further aspects of the invention will be explained in greater detail by way of example and with reference to the accompanying drawings in which:

Fig.1	is a general plan view of an assembly element of the invention;
Fig.2	is a view of a basic triangular assembly made of three elements as shown at Fig.1
Fig.3a	is a more detailed plan view of another embodiment of the assembly element of the invention;
Fig.3b	and 3c are cross-section of the embodiment shown at Fig.3a, respectively by plans IIIA and IIIB
Fig.4	is a perspective view of two interlocked assembly elements of the invention;
Fig.5	is a general plan view of an assembly built with elements of the invention;
Fig.6	is a more detailed view of a knot of elements as shown at Fig.5;
Fig.7	is a general, partly interrupted, view of another assembly of element of the invention;
Fig.8	is a perspective view of a way of connecting assembly elements in different planes;
Fig.9	a plan view of another kind of connecting element used with the assembly elements of the invention;
Fig.10, 11, 12 and 13	are exploded perspective views of other embodiments of assembly elements of the invention;
Fig.14, 15 and 16	are plan views of further possible embodiments of the heads of an assembly element;
Fig.17, 18, 19 and 20	are plan views of connection knots realised with embodiments of the heads as shown at Fig. 14, 15 and 16;
Fig.21 (a, b, c, d, e, f, g)	are plan views of various auxiliary connection elements or keys;
Fig.22 (a, b, c, d, e,)	are plan views of connection knots realised with embodiments of the keys as shown at Fig. 21 (a, b, c, d, e, f, g);

[0020] The figures are not drawn to scale. Generally, identical components are denoted by the same reference numerals in the figures. In order to distinguish various embodiment of a same component, variations are noted with the same significant number (XX) with increasing number of hundreds (YXX) .

Detailed description of preferred embodiments

[0021] Fig.1 displays a first embodiment of the assembly element 1 of the invention. It comprises essentially an elongated member or shaft 2 bearing at both ends similar but inverted connecting heads 4. At its halfway point each shaft 2 has two crosswise strips 6 which extend at 60° angles to each other and with respect to the main shaft 2.

[0022] As can be seen at Fig. 2, three elements 1 can be joined together by the heads 4 to form an equilateral triangle. If such a triangle is repeated and extended, equilateral hexagons and derivatives appear (see Fig 5), forming a lattice composed of multiple copies of one single element 1 and whose dimensions can be extended at will.

[0023] The dimensions (cross-section and length) of the assembly element are chosen so that, e.g. gardeners can obtain a quasi invisible support system which will keep even the most difficult plant clusters correctly in place. The stems are horizontally grouped in small packages at any desired height. Thus they keep each other upright. Sticks and string are not needed, only a few minutes of adjusting guarantee a year-long perfect result, irrespective of length, shape or nature of the plant clusters that need safeguarding. The strips 6 serve here as an added safeguard to keep the plant stems in place.

[0024] The elements once joined remain firmly in place, though when the plant needs to be pruned or has withered the lattice can be taken apart, damaging neither the elements nor the plants. In springtime, a lattice assembly, made to measure is placed on the shoots of a plant cluster. The plants will grow through it unimpeded. As the plants grow the grid is lifted, resting lightly on the new branches. Extra elements may easily be added to a lattice and extra layers of lattice assemblies can be fitted. Soon the lattice is not seen under overhanging leaves and the plant cluster is kept smartly in place. Stems that should sprout outside of the lattice can be contained by adding extra elements.

The characterizing features of the assembly element will be described more in detail by referring to Fig. 3a, b and c. Both ends of the elongated member bear a connecting forkshaped head 4. The fork 8 is made out of two branches, 10 and 12, the axis of each of the two branches 10 and 12 making an angle of about 30° with respect to the axis of the fork 8, which corresponds with the axis of the elongated member 2. The first branch 10 bears at its free end a dovetail tenon 14. The medium axis of the tenon 14 placed on this first branch 10 makes an angle α of 60° with the axis of the fork 8.

This first branch 10 further bears a false tenon 16 disposed symmetrical with the tenon 14. The lateral faces of the second branch 12, of the first branch 10 and of the false tenon 16 form a mortise 18 wherein the tenon 14 of another assembly element of the invention can be inserted. Assembly elements according to the invention thus allow the assembly of elegant planar structures. Examples thereof can be seen at Fig 5, 6 and 7. Fig 6 displays a more detailed view of a connection knot 19 of several connecting heads 6 of already described assembly elements. One can distinctively recognize a David Star, which illustrates the fact that assembly elements of the invention can be used to form e.g. elegant wooden separation wall, in ceilings, but also assembly toys.

[0025] However, it is to be noted that assembly elements of the invention also allows to obtain 3-D structures (see Fig 8). Indeed, as shown at Fig.3a, a mortise 18 can also accommodate a section of an elongated member 2 of another assembly element (see also Fig.3b).

[0026] The « normal » section of the elongated member as represented in this embodiment has the form of an irregular hexagon (commonly known as 'diamond').

To allow the possibility of interconnection of assembly elements in more than a single plane, the elongated member (or shaft 2) of a first element 1 shown at Fig. 3a bears at a given place along its length an insertion section 20 of reduced (square) width (see Fig 3 c).

The sides of this square section have a length corresponding to (or smaller than) the width of the mouth of a mortise 18 of a second assembly element, so that the shaft 2 of this first element can be inserted into this mortise; a relative translation of the two assembly elements locks the shaft 2 into the mortise 18, that can be slid up to the required place along the shaft 2(as shown at Fig 4).

Once interlocked, separate assembly elements are firmly maintained in place by interlocking means 22, 24. As examples of interlocking means, one may cite plastic pins and recesses, nylon inserts, resilient means and so on.

[0027] Fig.9 shows a first auxiliary assembly element 25 allowing two assembly elements to be connected lengthwise. This first auxiliary assembly element comprises two dovetail tenons 114 placed parallel to each other so that they can be combined with the connecting heads 4 of two assembly element 1 as described above. The dovetail tenons 114 of this auxiliary assembly element are borne by two segments 26 whose cross-section corresponds to the cross-section of the elongated members 2.

[0028] Assembly elements according to the invention can be used as toys. As building block toys, they provide an opportunity for responsible activity. It allows the young user to make acquaintance with less common attributes of space. In contrast to most construction toys it is not based on a Cartesian space with three axes. Here, a flat assembly has three axes and the step to creating a third dimension can happen in six directions. The design of the assembly elements within a flat assembly gives a pleasing overall woven effect.

[0029] Exploring this space gives one a sense of discovery, making it appealing to all ages. The present elements 1 are not intended to be used to build "concrete" forms such as vehicles or toy weapons but rather to stimulate the imagination. They thus provide a very different approach from innumerable other building block systems. In spite of the unlimited possibilities they provide, they remain a structured system whose limitations determine the rules of the game.

[0030] Assemblies made out of assembly elements according to the invention are however not limited to gardening, bowers, separation walls ornamented with openwork or toys: they can also be used for construction elements and carpentry. Fig 10, 11, 12, 13 display examples of embodiments of moulded connections heads 104 associated with metal shafts 2 of various sections.

[0031] Assembly elements according to the invention are further not limited to 60° assemblies. By varying the position of the tenon 14 on the first branch 10, it is possible to obtain connections of elements 1 according to various angles.

[0032] Fig 14, 15, 16 display various connection heads 104, 204, 304 wherein the angle between the medium axis of the tenon 14, 114, 214, 314 and the axis of the fork are respectively 60, 90 and 120°, i.e. are in the form of $\alpha = (60+n*30°)$ (with "n" having a value of 0,1 or 2). Corresponding assemblies knots (119, 219, 319, ...) are shown at Fig 17, 18, 19, 20 (with possible angles between the shafts of 60, 90, 120°).

[0033] It is also possible to vary the angle between converging elements 1 by using different compatible connection heads 104, 204, etc.

[0034] To avoid weakening connection knots (119, 219, 319, ...), connection keys (28, 128, 228, etc.) of various forms can be inserted in a knot (119, 219, 319, ...). A connection key (28, 128, 228, etc.) has roughly the same shape as a connecting head 4, but without supporting shaft 2. Examples of connection keys (28, 128, 228, etc.) are shown at Fig 21 (a, b, c, d, e, f, g).

[0035] Examples of assemblies using a combination of connection heads 104, 204, 304 and connection keys (28, 128, 228, etc.) are displayed at Fig 22(a, b, c, d, e).

Claims

1. An assembly element (1) **characterized in that** it comprises an elongated member (2) extending along an axis

bearing, at at least one of its ends, a connecting head (4) , said head (4) comprising a fork (8) made out of two branches (10,12), the axis of each of the two branches making an angle of about 30° with respect to the axis of the fork(8), which corresponds with the axis of the elongated member (2), a first branch (10) bearing at its free end a dovetail tenon (14), the proximal face of the first branch (10) forming, together with the second branch (12), a dovetail mortise (18) whose dimensions correspond to the dimensions of the dovetail tenon (14), so as to allow a sliding assembly of the connecting heads (4) of two assembly elements (1).

2. An assembly element (1) according to claim 1, **characterized in that** the medium axis of the tenon (14) placed on the first branch (10) makes an angle α of 60+(n x 30°) with the axis of the fork (8), the value of n being [0, 1, 2].

3. An assembly element (1) according to either one of claims 1 or 2, **characterized in that** the dovetail tenon (14) and mortise (18) have the form of isosceles trapeziums whose base angle is 60°.

4. An assembly element according to anyone of the preceding claims, **characterized in that** the value of angle α is 60°, six converging assembly elements (1), when assembled, forming a David star.

5. An assembly element (1) according to anyone of the preceding claims, **characterized in that** the head (4) and the elongated member (2) extend in a plane, the elongated member (2) comprising planar faces extending normal to this plane.

6. An assembly element (1) according to claim 5, **characterized in that** the elongated member (2) has a hexagonal or diamond cross-section, two sides of the hexagon or diamond extending normal to the plane having a length corresponding to the width of the mouth of a head's mortise (18) and being separated by a distance also corresponding to the width of the mouth of a head's mortise (18).

7. An assembly element (1) according to anyone of the preceding claims, **characterized in that** the elongated member (2) of a first element (1) comprises at least one part of cross-section allowing its connection with a connecting head (4) of a second assembly element (1) extending in another plane.

8. An assembly element (1) according to any one of claims 5 to 7, **characterized in that** the elongated member (2) of a first element (1) comprises at least one segment of square cross-section, a side of this square having a length corresponding to the width of the mouth of a head's mortise (18), allowing the insertion of a connecting head (4) of a second assembly element extending in another plane, normal to the plane of the first element.

9. An assembly element according to anyone of the preceding claims, **characterized in that** the elongated member (2) comprises diverging strips (6) for binding items to this elements.

10. A first auxiliary assembly element to be used in conjunction with assembly elements according to anyone of the preceding claims, **characterized in that** this auxiliary assembly element comprises, placed parallel to each other, two dovetail tenons allowing two reverted assembly elements to be connected lengthwise, the dovetail tenons of this auxiliary assembly element being borne by two segments placed sidewise of hexagonal cross-section corresponding to the hexagonal cross-section of the connected elongated members.

11. A second auxiliary assembly element (28) to be used in conjunction with assembly elements and first auxiliary assembly elements according to anyone of the preceding claims, **characterized in that** this second auxiliary assembly element (28) has the shape of a head (4) of an assembly element and serves to complete the locking of a plurality of converging assembly elements (1), the medium axis of the tenon (14) placed on the first branch (10) making an angle α of 60+(n x 30°) with the axis of the fork (8), the value of n being [0, 1, 2, 3, 4, 5 or 6] .

12. An assembly element (1) or first or second secondary assembly element (28) according to anyone of the preceding claims, **characterized in that** the connecting head (4) comprises at least one locking device (22, 24) maintaining in place the connecting heads (4) of two assembled elements.

Amended claims in accordance with Rule 137(2) EPC.

1. An assembly element (1) comprising an elongated member (2) extending along an axis bearing, at at least one of its ends, a connecting head (4), **characterized in that** said head (4) comprises a fork (8) made out of two branches

(10,12), the axis of each of the two branches making an angle of about 30° with respect to the axis of the fork(8), which corresponds with the axis of the elongated member (2), a first branch (10) bearing at its free end a dovetail tenon (14), the proximal face of the first branch (10) forming, together with the second branch (12), a dovetail mortise (18) whose dimensions correspond to the dimensions of the dovetail tenon (14), so as to allow a sliding assembly of the connecting heads (4) of two assembly elements (1).

2. An assembly element (1) according to claim 1, **characterized in that** the medium axis of the tenon (14) placed on the first branch (10) makes an angle α of 60+(n x 30°) with the axis of the fork (8), the value of n being [0, 1, 2].

3. An assembly element (1) according to either one of claims 1 or 2, **characterized in that** the dovetail tenon (14) and mortise (18) have the form of isosceles trapeziums whose base angle is 60°.

4. An assembly element according to anyone of the preceding claims, **characterized in that** the value of angle α is 60°, six converging assembly elements (1), when assembled, forming a David star.

5. An assembly element (1) according to anyone of the preceding claims, **characterized in that** the head (4) and the elongated member (2) extend in a plane, the elongated member (2) comprising planar faces extending normal to this plane.

6. An assembly element (1) according to claim 5, **characterized in that** the elongated member (2) has a hexagonal or diamond cross-section, two sides of the hexagon or diamond extending normal to the plane having a length corresponding to the width of the mouth of a head's mortise (18) and being separated by a distance also corresponding to the width of the mouth of a head's mortise (18).

7. An assembly element (1) according to anyone of the preceding claims, **characterized in that** the elongated member (2) of a first element (1) comprises at least one part of cross-section allowing its connection with a connecting head (4) of a second assembly element (1) extending in another plane.

8. An assembly element (1) according to any one of claims 5 to 7, **characterized in that** the elongated member (2) of a first element (1) comprises at least one segment of square cross-section, a side of this square having a length corresponding to the width of the mouth of a head's mortise (18), allowing the insertion of a connecting head (4) of a second assembly element extending in another plane, normal to the plane of the first element.

9. An assembly element according to anyone of the preceding claims, **characterized in that** the elongated member (2) comprises diverging strips (6) for binding items to this elements.

10. A first auxiliary assembly element to be used in conjunction with an assembly element according to any of the preceding claims, **characterized in that** this auxiliary assembly element comprises, placed parallel to each other, two dovetail tenons allowing two reverted assembly elements to be connected lengthwise, the dovetail tenons of this auxiliary assembly element being borne by two segments placed sidewise of hexagonal cross-section corresponding to the hexagonal cross-section of the connected elongated members.

11. A second auxiliary assembly element (28) to be used in conjunction with an assembly element according to any of claims 1 to 9, **characterized in that** this second auxiliary assembly element (28) has the shape of a head (4) of an assembly element and serves to complete the locking of a plurality of converging assembly elements (1), the medium axis of the tenon (14) placed on the first branch (10) making an angle α of 60+(n x 30°) with the axis of the fork (8), the value of n being [0, 1, 2, 3, 4, 5 or 6].

12. An assembly element (1) or first or second secondary assembly element (28) according to anyone of the preceding claims, **characterized in that** the connecting head (4) comprises at least one locking device (22, 24) maintaining in place the connecting heads (4) of two assembled elements.

Fig 1

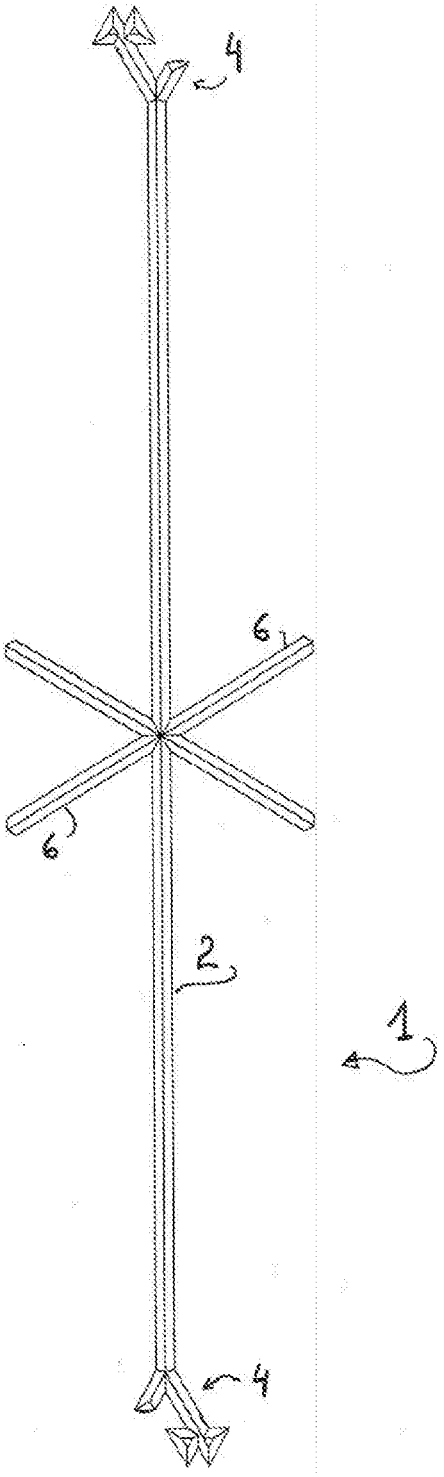


Fig 2

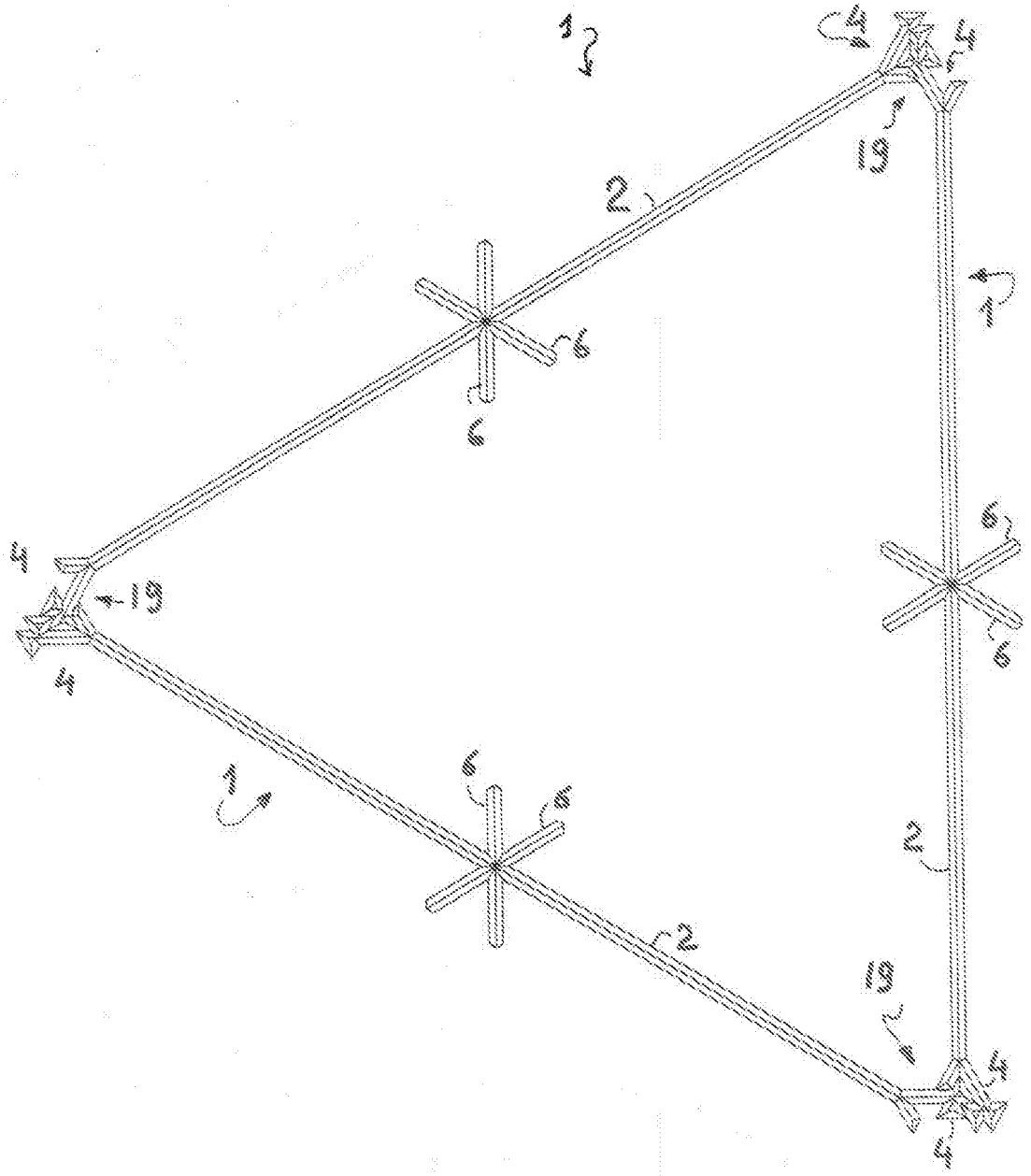


Fig 3a

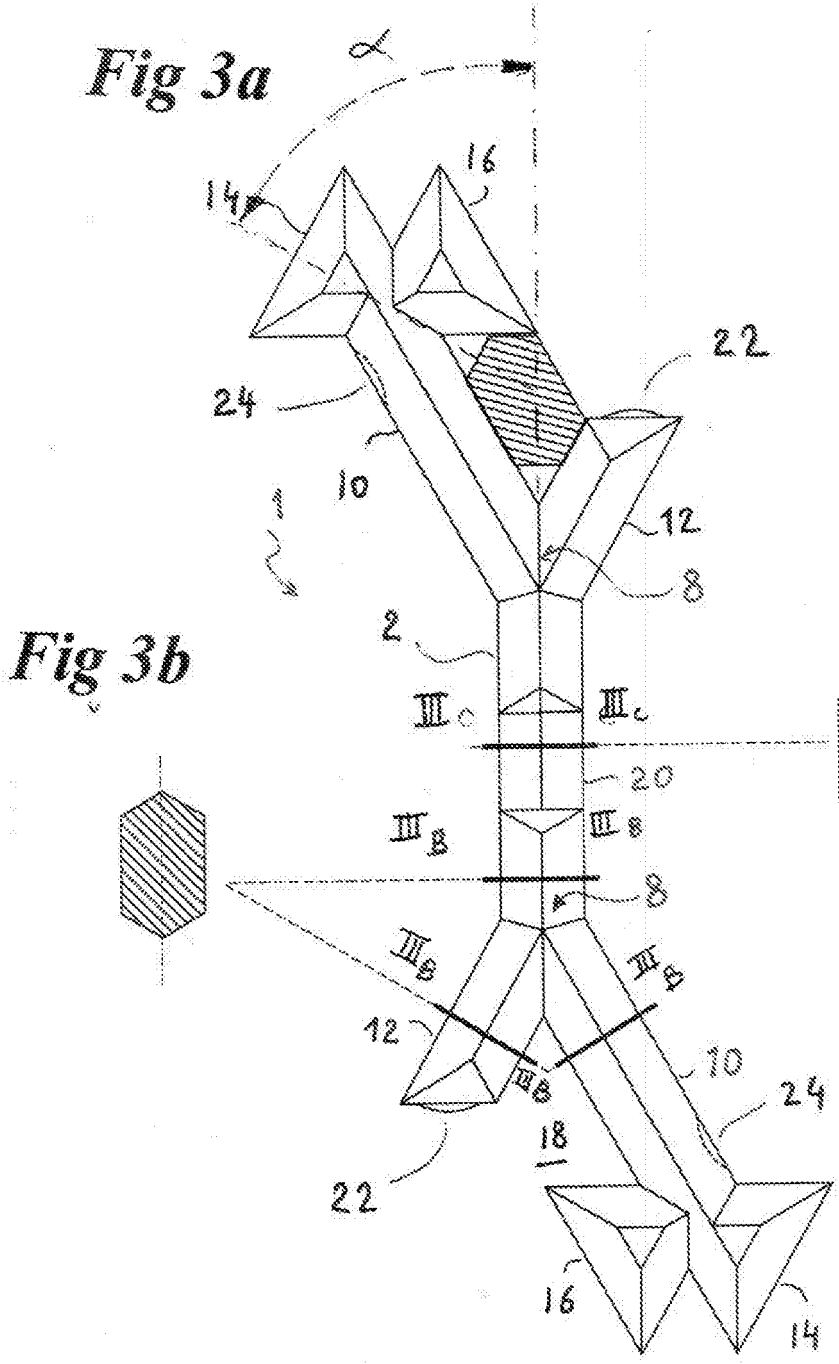


Fig 3b

Fig 3c

Fig 5

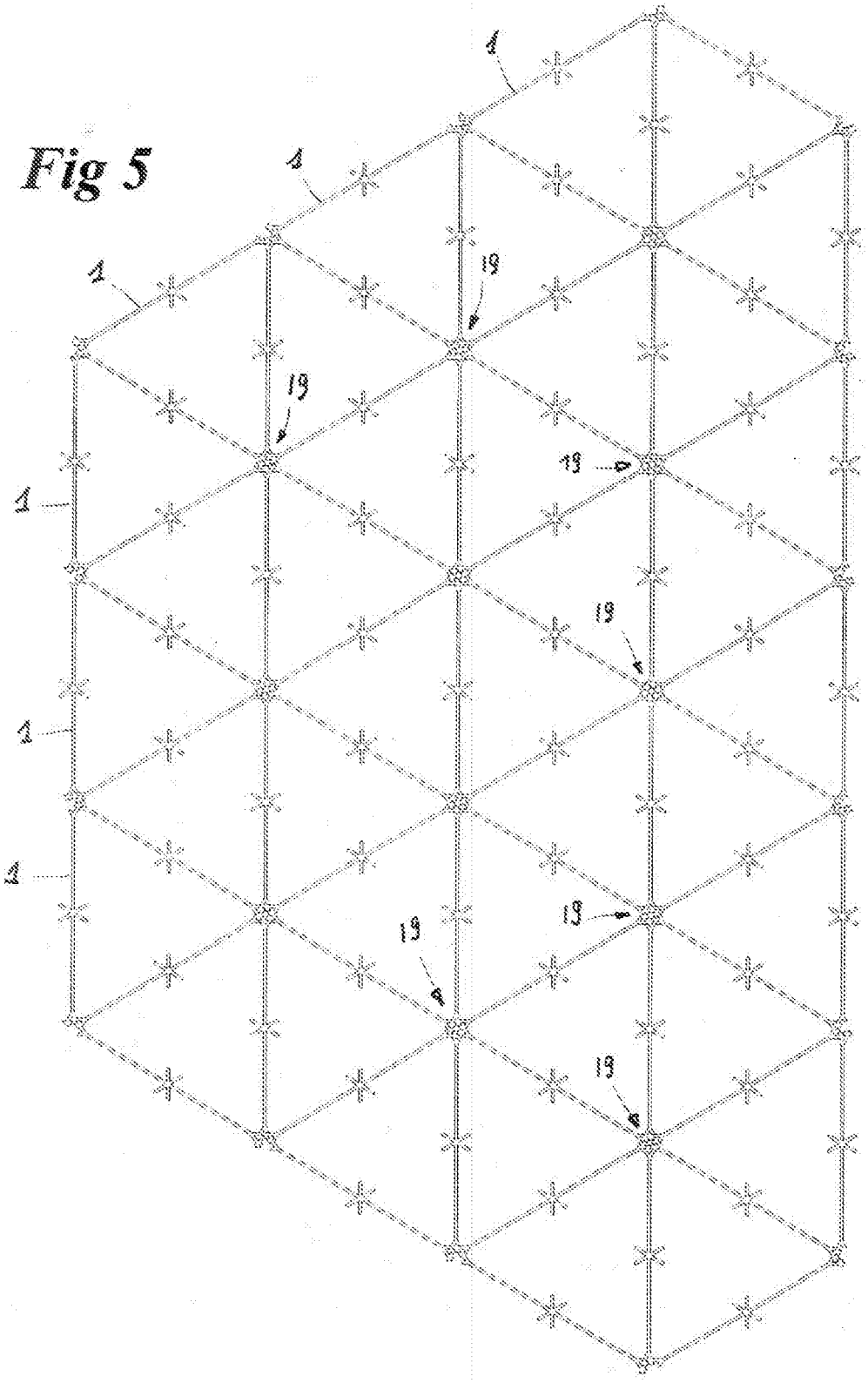
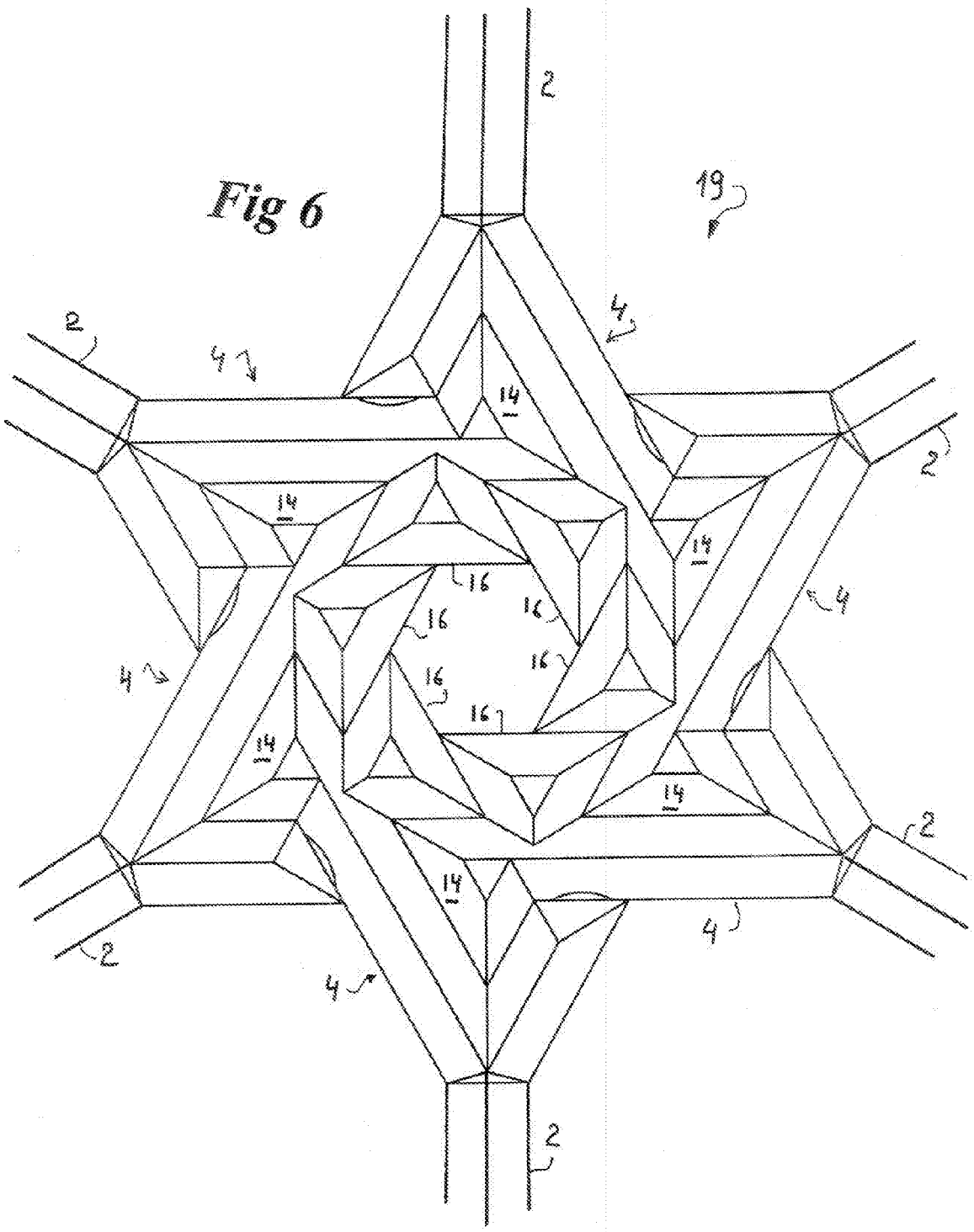


Fig 6



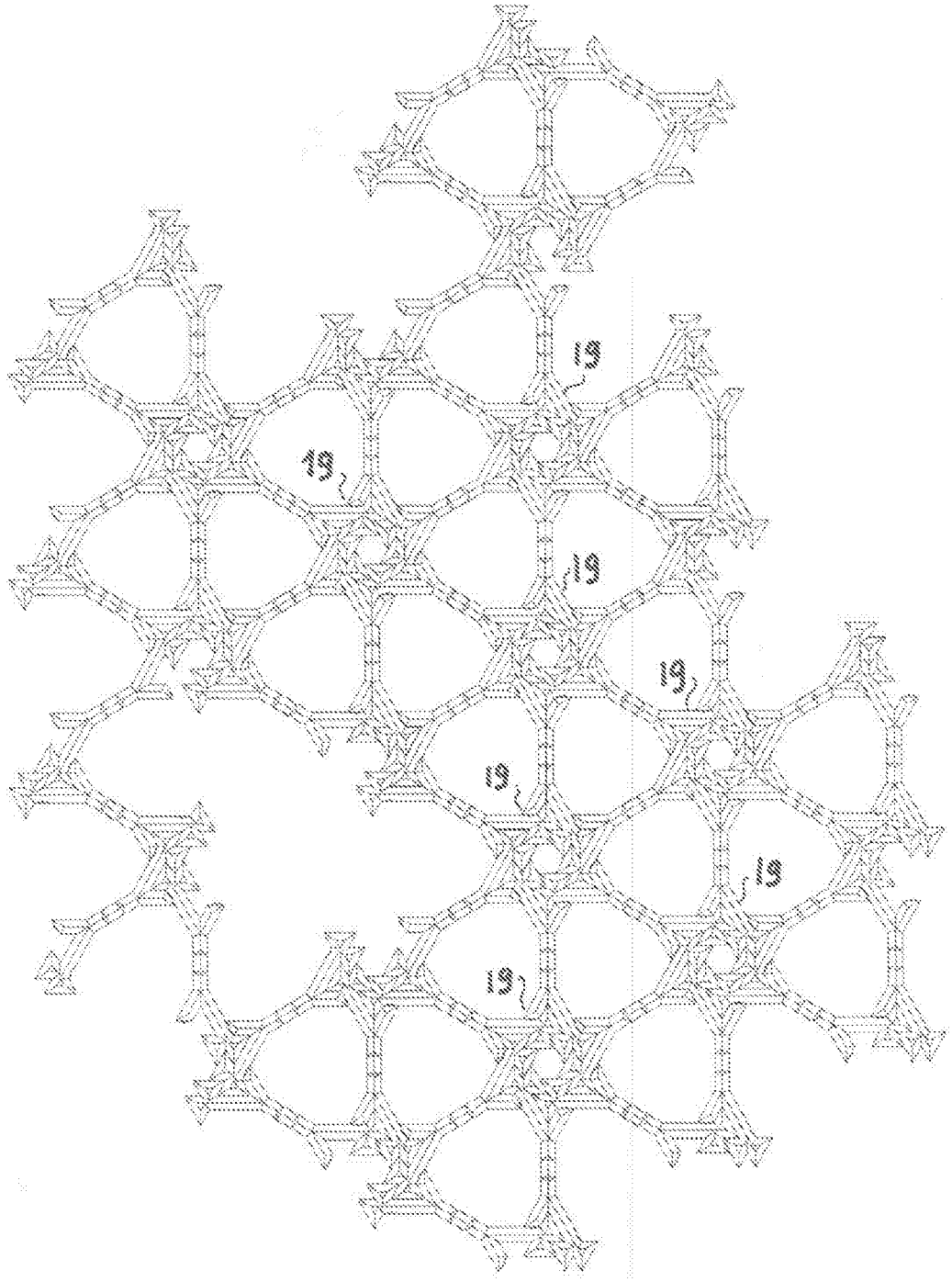


Fig 7

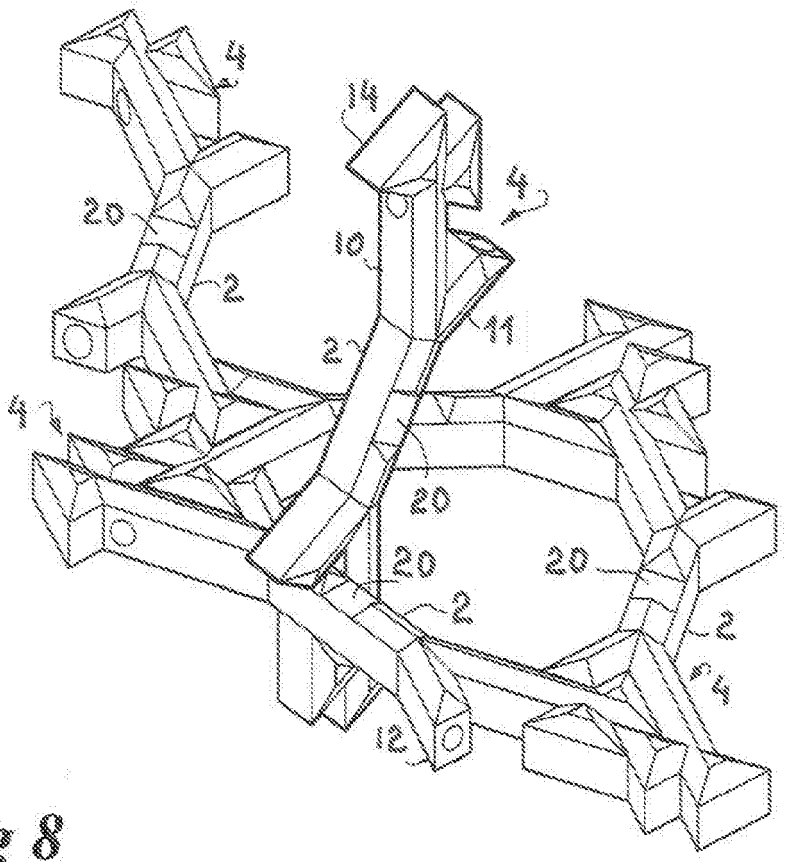


Fig 8

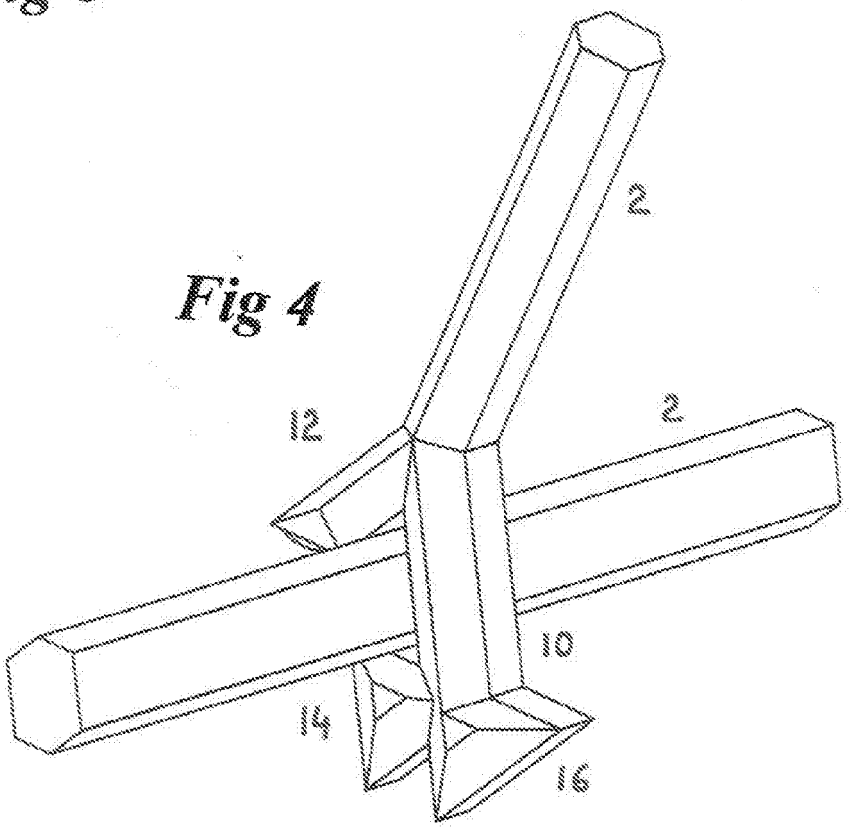
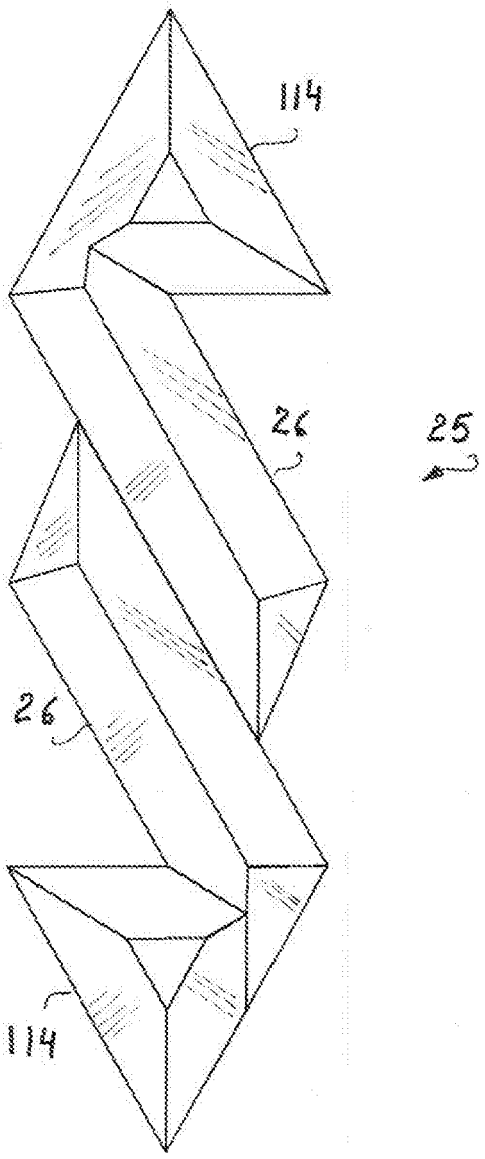


Fig 4

Fig 9



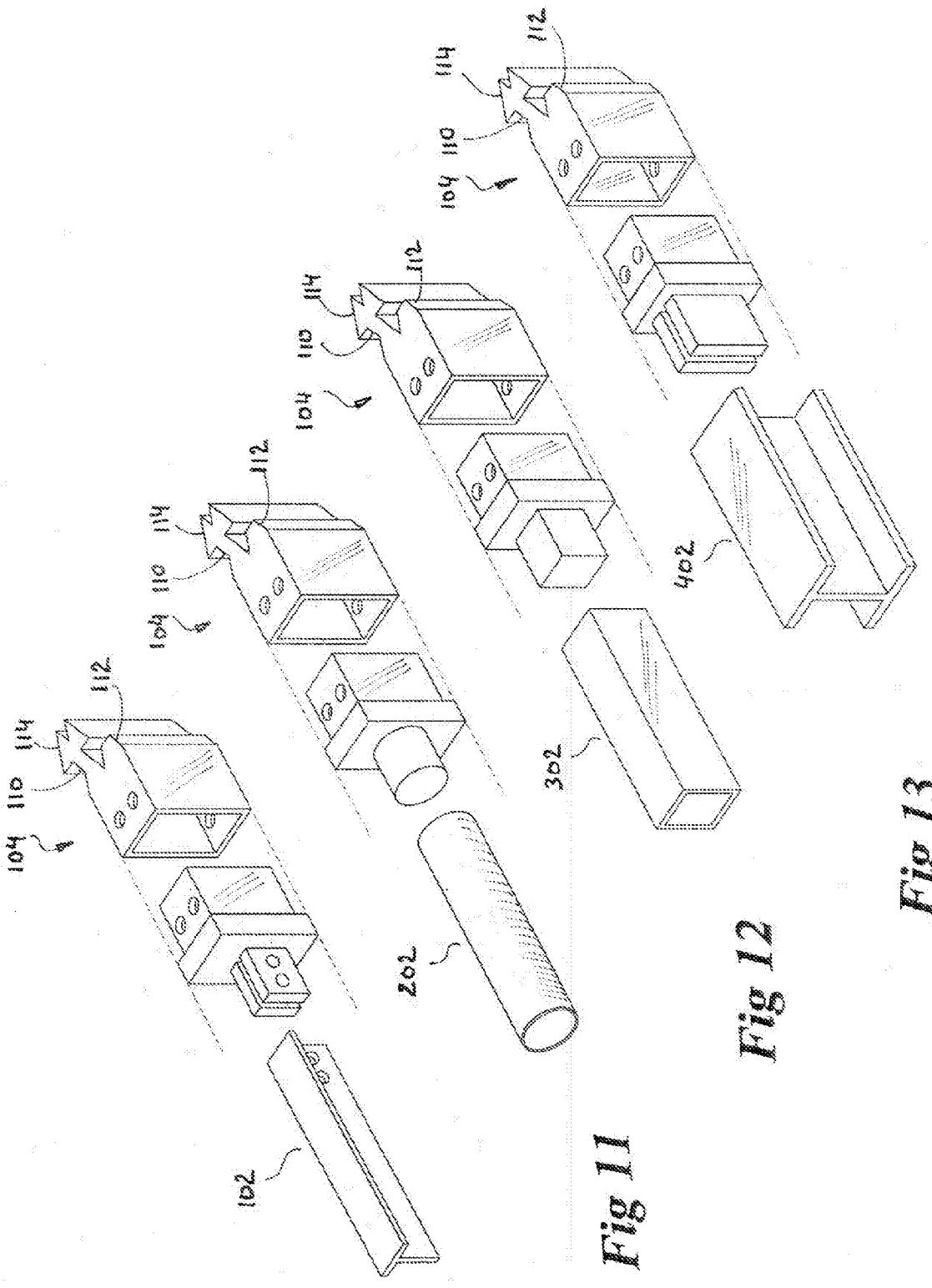


Fig 10

Fig 11

Fig 12

Fig 13

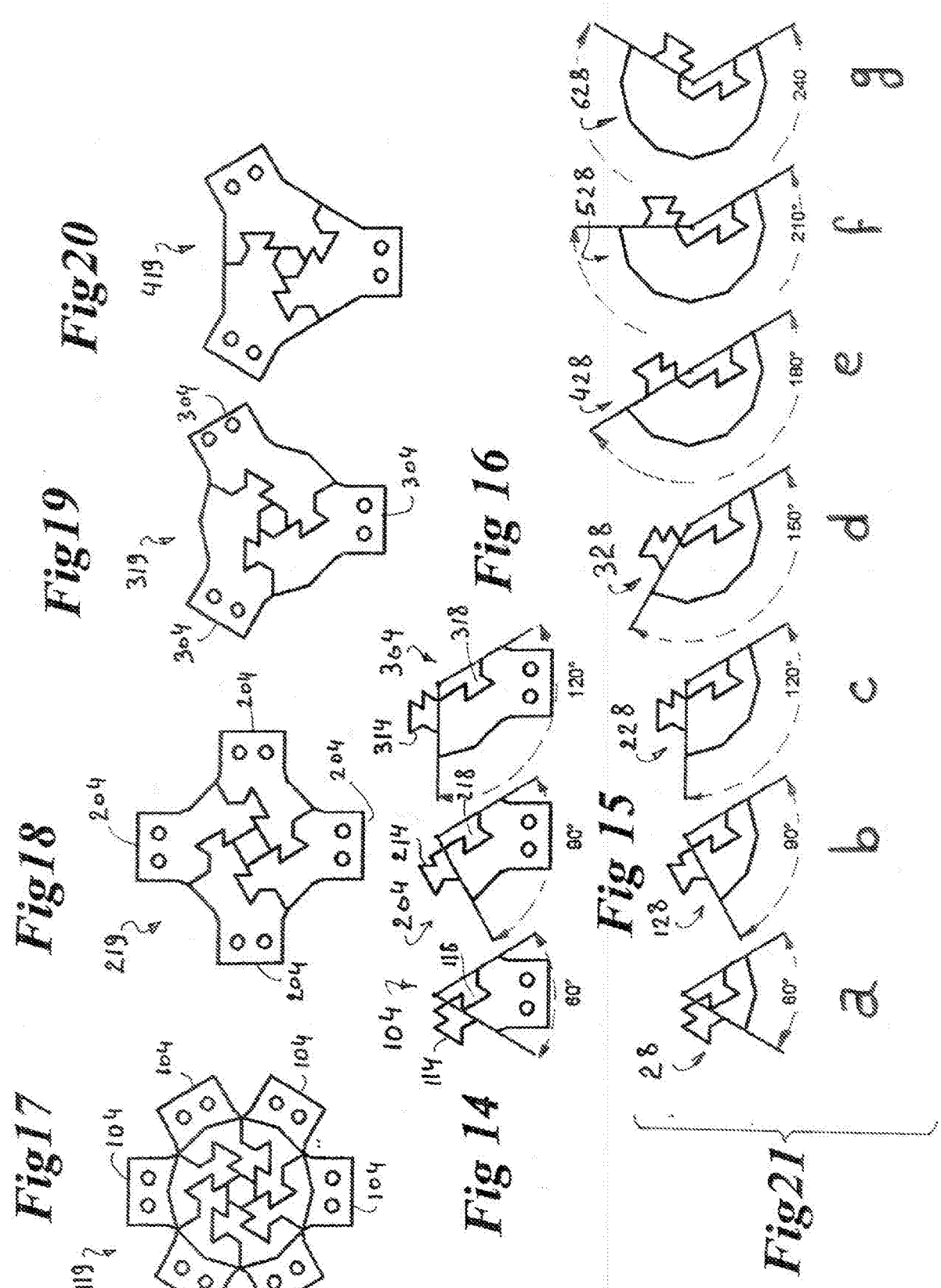


Fig17
119
104
Fig18
219
204
Fig19
319
304
Fig20
419
Fig 14
104
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116
214
218
60°
120°
Fig 16
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314
318
Fig 15
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120°
150°
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28
a b c d e f g
Fig21

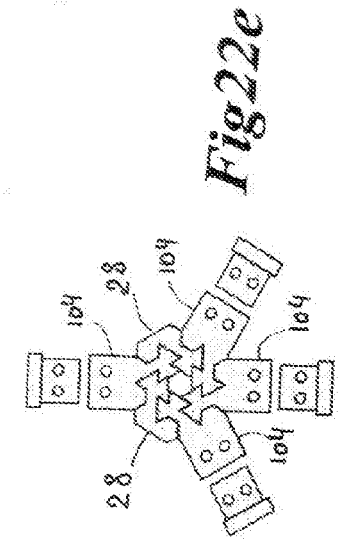

Fig22e

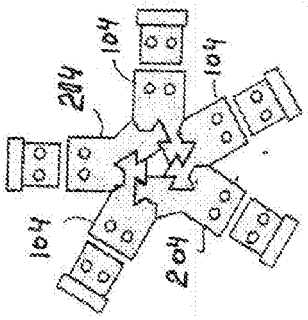

Fig22f

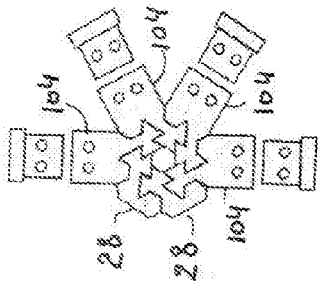

Fig22d

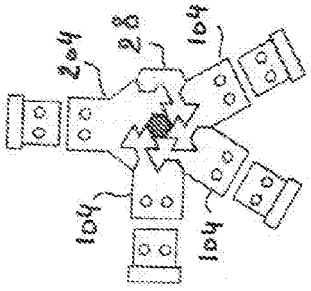

Fig22c

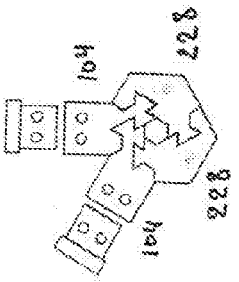

Fig22b

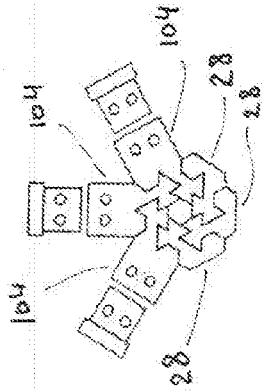

Fig22a

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Application Number
EP 06 12 2732

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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
Munich	4 April 2007	Lucas, Peter

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