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(54) A SYSTEM FOR ERECTING CLIMBING WALLS BY MEANS OF STANDARDIZED ELEMENTS

(57) With the system of the invention, standard panel elements (5, 6) in the shape of flat surfaces and fabricated by standardized procedures are joined with each other by various connecting elements. A plurality of various bodies can be assembled from triangles, rectangles, pentagons, hexagons and other polygons, i.e. standard panel elements having equally long sides. According to the system of the invention any number of standard panel elements, i.e. polygons, can be joined with each other in order to design a climbing wall or a climbing surface tailored to user's wishes. Each standard panel element in the assembly that makes up a dimming wall is joined with another standard panel element by way of a connecting element. All standard panel elements are subject to a condition that they are equally processed on their circumference. In order to provide for a precise matching of standard panel elements, from which a climbirtg evall is made up, regardless of their mutual combinations and position, the circumferences and edges, with which the standard panel elements are joined with each other, must match in length and a joint between them must provide for adequate stability with a possibility of simple assembly and disassembly regardless of the angle, at which the standard panel elements are joined with each other. Connecting elements can be of various types: angle elements (4), hinge joint or folding joint (12). The standard panel elements can thus be combined in an unlimited number of ways and a set of the standard panel elements can constantly be optimized.

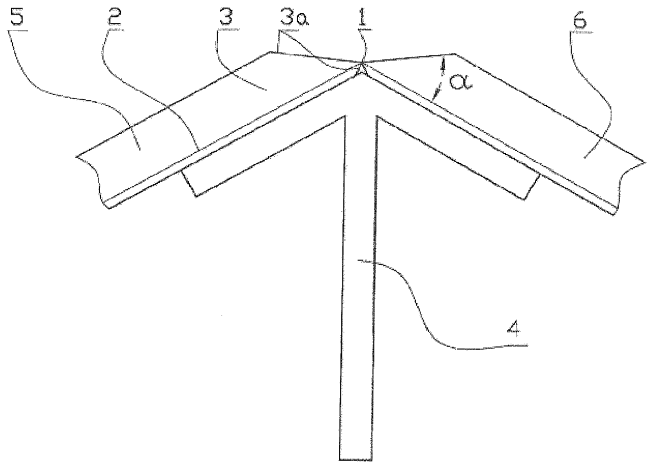

Figure 1

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Description

Field of Invention

[0001] The invention belongs to the field of climbing walls for all disciplines of sport climbing on artificial walls. The invention refers to a new system for erecting climbing walls. More specifically, the invention refers to a climbing wall that can be fabricated, transported, assembled and changed in a simple way with a limited number of elements. The elements that make up the system are fabricated serially in a reproducible and controllable quality. The system of the invention provides unlimited freedom in functional design of climbing surfaces and climbing walls, in fact it provides for a custom-made climbing wall fabrication.

[0002] The invention also covers a small-scale system designed for making climbing wall maquettes where a user erects a small-size maquette and orders a climbing wall based on this maquette, and for training of spatial perception as a brain game.

Background of Invention

[0003] Sport climbing has become a popular sport. We are facing an abundance of climbing walls and user's requirements have become more demanding and versatile. It is often difficult to make a good compromise between appearance and applicability, It often happens that the users quite rapidly find out that the wall fails to meet their expectations that the appearance seemed to promise. A wish for a change follows soon thereafter. A few changes can be made in certain cases by adding large climbing holds - volumes; however an integral change in the wall configuration is an expensive and demanding procedure.

[0004] Long years of commitment to providing conditions for training of sport climbers from children to world cup contestants have brought much experience. The first important fact is that something that looks good is not necessarily applicable. The second fact is that the users get relatively rapidly bored with any installed configuration of a wall. Flat surfaces can be made more interesting if large-size climbing holds called volumes are added. One problem is herewith solved yet another arises. Generally, the volumes are not fixed to a wall at dedicated fitting sites but where the holes in the volumes allow this. Such a solution may be questionable from the point of view of compatibility with the standard and clearly defined safety. A still bigger problem is very variegated wall configurations. More demanding users get bored with them even more rapidly and adjustment by means of volumes is more difficult or even impossible. A wall configuration needs therefore be changed several times a year and for the needs of contestants especially as a function of a training process.

[0005] Climbing walls are usually made of wood and composite boards that are used as climbing surfaces and are joined with each other in various known ways such as screw connections and from fabricated simply drawn, rolled or sprayed profiles from wood, metals or composites. When erecting a wall a fixed support structure is usually installed, on which elements made of wood or composite materials of a climbing surface are screwed. Additional mutual joining of elements of a climbing surface has no point in this case. This fixed structure can be standalone or fastened to another standalone structure. Sometimes conventional construction parts such as pipes and collars are used for the erection of a support structure. Such construction clearly shows real advantages of the use of conventional standardized elements - low price, simple assembly as well as simple and reliable calculation, however it occupies much space and does not allow any special creativity, in fact any change to the shape of a climbing wall or of a climbing surface is difficult or rather impossible.

[0006] A need was therefore felt for a system that will provide the users with a cost effective and reliable adjustment of climbing walls to current needs.

Scope of Invention

[0007] The mentioned technical problem is solved by a system for erecting climbing walls according to the invention. With the system according to the invention, standard elements in the shape of flat surfaces and fabricated by standardized procedures are joined with each other by various connecting elements. A plurality of various bodies can be assembled from triangles, rectangles, pentagons, hexagons and other polygons, i.e. standard elements having equally long sides. According to the system of the invention any number of standard elements, i.e. polygons, can be joined with each other in order to design a climbing wall or a climbing surface tailored to user's wishes. Each standard element in the assembly that makes up a climbing wall is joined with another standard element by way of a connecting element. All standard elements are subject to a condition that they are equally machined on their circumference. In order to provide for a precise matching of standard elements, from which a climbing wall is made up, regardless of their mutual combinations and position, the circumferences, i.e. the edges, with which the standard elements are joined with each other, must match in length and a joint between them must provide for adequate stability with a possibility of simple assembly and

disassembly regardless of the angle, at which the standard elements are joined with each other.

[0008] A theoretical distance between the two opposite vertices of mutually joined standard elements must be equal to the theoretical length of the edges, with which two standard elements are joined with each other. The terms theoretical distance and theoretical length refer to a distance and a length that would exist if the circumferences of the standard elements were not additionally machined. If the theoretical length of both edges, with which two standard elements are joined with each other, is not equal, of course within the allowed tolerances, to the theoretical distance between both vertices of the corresponding joint, an error occurs. Summing up of errors exceeding the tolerances in huge assemblies- in huge climbing walls or climbing surfaces - inevitably means that the assembly cannot be completed.

[0009] Connecting elements can be of various types: angular elements, hinge joint or flexible joint. The standard elements can thus be combined in an unlimited number of ways and a set of the standard elements can constantly be optimized.

[0010] The invention will be explained in more detail by way of embodiments and drawings.

Figure 1 shows a cross-section of a joint of two standard panel elements by means of an angular connecting element.

Figure 2 shows a cross-section of a joint of two standard panel elements with a focus being on the machining of the circumference of the elements in order to ensure the tolerances.

Figure 3 shows parameters that are important for the calculation of positions of holes on an angular connecting element.

Figure 4 shows a cross-section of a hinge joint.

Figure 5 shows a cross-section of a flexible joint.

[0011] Let us presume, for the ease of understanding, that the standard panel elements have a zero thickness. Such element with a zero thickness is defined in the present application as a project standard element. In this case, each project standard element has the number of edges that equals the number of angles. Project standard elements can be joined with each other only when the lengths of the abutting edges of both elements precisely match. This means that both vertices on the abutting edge precisely overlap as well.

[0012] In reality, standard panel elements that are joined with each other have a certain thickness. If standard panel elements are to be joined at various angles, they must have a property of a project standard element at contacts - the zero thickness. To make a standard panel element having properties of a project standard element at contacts, a standard panel element needs to be chamfered along their entire circumference at an angle preferably of 30 to 40 degrees relative to the project standard element. As the standard panel elements are chamfered they cannot be joined at any angle like project standard elements; the angle of chamfering determines possible angles of joining.

[0013] Project standard elements 2 that are only visible as lines in the cross-section shown in Figure 1 due to the zero thickness abutting to each other in a point that actually represents an edge 1, in which two equally long edges of two project standard elements 2 abutting each other. As elements with the zero thickness do not exist in reality a solution needs to be found for standard panel elements 5, 6 having a certain thickness. The standard panel elements 5, 6 and their circumferences 3 are in cross-section shown as flat surfaces. In order to reach the functionality of a project standard element the circumference 3 of the standard panel element 5, 6 need to be machined. The standard panel elements 5, 6 are therefore chamfered along their circumference 3 at an angle in order to obtain the sharpest possible edge at the edge 1 of the project standard element 2. The circumference 3 is thus defined with two chamfered flat surfaces 3a abutting to each other in the edge 1. These two flat surfaces 3a are inclined towards the project standard element 2 at an angle α preferably in the range from 30 to 40 degrees. The smaller this angle, the larger the range of angles, at which the standard panel elements 5, 6 can be joined with each other. The circumference 3 of both standard panel elements 5, 6 can be chamfered symmetrically or asymmetrically, wherein the chamfering is preferably made in a way that a distance of a connecting element 4 from the project standard element 2 is as small as possible, preferably between 1 mm and 5 mm. A huge distance between the connecting element 4 and the project standard element 2 causes problems in arranging holes for fastening on the connecting element 4. A too small distance means a too sensitive edge 1 of the standard panel element 5, 6.

[0014] If the circumference 3 of the standard panel element 5, 6 is chamfered along the entire circumference 3 at an angle of 35 degrees, wherein the chamfering is preferably equal at both sides, the minimum possible joining angle is 70 degrees and the maximum is 290 degrees.

[0015] A tendency is to have as small angle as possible. A limitation is the stability of the so formed edge 1 which is too thin and therefore too sensitive. The obtained edge 1 is therefore additionally chamfered, preferably for 1 mm, as shown in Figure 2. If both chamfered flat surfaces 3a abutting to each other in the edge 1, the circumference 3 of the

standard panel element 5, 6 is very sensitive and also dangerously sharp. Another problem arises due to the needed tolerances during the assembly. In order to avoid said problems the standard panel element 5, 6 is additionally chamfered or reduced such that the edge 1 is additionally chamfered or ground off and an additional flat surface 3b is formed on the circumference 3 between the flat surfaces 3a. The circumference 3 is thus defined by two flat surfaces 3a and the flat surface 3b. In the joint between both standard panel elements 5, 6 a narrow slot is thus formed between the flat surface 3b of the element 5 and the flat surface 3b of the element 6 and represents a tolerance range for assembly. A tolerance range is a prerequisite when assembling a climbing wall or when joining standard elements with each other.

[0016] The standard panel element is therefore preferably by 1 mm smaller along the entire circumference than the project standard element. If a project standard element is a square with a side of 100 mm, than a standard panel element is a square with a side or preferably 98 mm.

[0017] All flat surfaces on the circumference of all standard elements are machined equally.

[0018] The connecting elements are angular connecting profiles adapted to the actual angle between the two standard panel elements and the position of fastening holes. Various angles require various angular connecting profiles; this increases the number of connecting elements but this mode of connection brings about obvious advantages in safety matters. These angular connecting profiles are so strong that each carries a maximum test load of 20 kN. They simultaneously serve as an aid in self-support of small climbing walls or sections of climbing walls without protection points. A climbing wall is fastened to a building or another support structure with these angular connecting profiles. Protection points are also fastened to these angular connecting profiles. In one protection line all protection points are connected with each other via these angular connecting profiles and in the event that one protection point fails the load is taken over by the neighbouring points.

[0019] Fastening of angular connecting profiles 4 and standard panel elements 5, 6 is carried out through the holes formed both in the angular connecting profile 4 and the standard panel element 5, 6. Fastening is carried out in various ways that are known to the persons skilled in the art, preferably via a screw connection.

[0020] Figure 3 shows parameters that are important in the calculation of positions of the holes on an angular connecting profile 4. Holes 9 for fastening a climbing wall or for joining the standard panel elements 5, 6 to the angular connecting profile 4 are equidistant from the edge 1 on the standard panel elements 5, 6, said edge 1 actually representing a line segment or an edge, in which two equally long edges of the two project standard elements 2 abutting to each other. The position of the holes 9 changes on the angular connecting profiles 4; the position of the holes 9 depends on an angle 10, at which two standard panel elements 5, 6 join with each other, and on the distance of the angular connecting profile 4 from the project standard element 2.

[0021] The distance of the centre of the hole 9 from a top 8 of the angular connecting profile 4 changes according to the following formula

$$LR=L-RAZ \times TAN((90-ANGLE/2)/360 \times 2PI))$$

wherein:

LR - real distance of the centre of the hole 9 from the top 8 of the angular connecting profile 4

L - distance of the centre of the hole 9 from the edge 1

RAZ - distance of the angular connecting profile 4 from the project standard element 2

ANGLE - angle 10 between both flat surfaces in arc degrees

[0022] Other ways of joining standard panel elements with each other are also possible. One possible type of a connecting element is a hinge joint with a pivotal point in the common connecting edge of two neighbouring standard panel elements of a climbing surface as shown in Figure 4. A hinge joint is made of two parts 14, 15, wherein each part is fastened to the standard panel element 5, 6 in a way known to a person skilled in the art, for instance in an L-shape as shown in the figure. The project standard elements 2 intersect in a line 16 that represents an axis 17 of the hinge joint, with which the standard panel elements 5, 6 are joined. In this case, the project standard element 2 is preferably virtually arranged in the centre of the standard panel element 5, 6.

[0023] A variant of a hinge joint is a flexible joint made from an adequate metallic, polymeric or composite material with a deforming area in the common connecting edge of two neighbouring standard panel elements of a climbing surface

as shown in Figure 5. A rapid development of materials provides a huge potential to this solution especially at the contacts which cannot carry huge loads.

[0024] A joint between the standard panel elements 5, 6 and a flexible joint 12 is carried out in various ways known to a person skilled in the art, for instance in an L-shape as shown in Figure 5. The project standard elements 2 intersect in a point or a line that represents a common connecting edge 13. A thickness d1 of the flexible joint 12 that equals the thickness of the standard panel elements 5, 6 to be joined, linearly reduces from both sides towards the common connecting edge 13 up to a thickness d2. A ratio between the thicknesses d2:d1 is within a range from 1:2 to 1:4 in order to still provide for the necessary stability of the joint.

[0025] As the cross-section, i.e. the thickness of the flexible joint 12 in the connecting edge 13 is reduced, the flexible joint 12 can undergo an elastic or plastic deformation, wherewith an optional angle can be obtained, at which both standard panel elements 5, 6 are joined. In this case, the project standard element 2 is preferably virtually arranged in the centre of the standard panel element 5, 6.

[0026] From the stability point of view, the hinge joint and the flexible joint are considerably poorer than the joint with an angular connecting element. They can only be used to join a limited number of elements in the assembly.

[0027] Other ways of joining may be used in practice, which, however, do not limit the scope of the invention.

Claims

1. A system for erecting climbing walls by means of standardized elements **characterized in that** it comprises:

   - standard panel elements (5, 6) which are polygons in the shape of flat surfaces and having equally long sides, wherein all standard panel elements (5, 6) have equally machined circumferences (3), such that the circumferences (3) or the edges, with which the standard panel elements (5, 6) are joined with each other, match in length, and
   - connecting elements that provide for the stability of the joint and simple assembly and disassembly regardless of the angle, at which the standard panel elements (5, 6) are joined with each other.

2. The system according to claim 1 **characterized in that** the connecting element is an angular connecting profile (4).

3. The system according to claim 1 and 2 **characterized in that** the circumference (3) of the standard panel element (5, 6) is defined with two chamfered flat surfaces (3a) that are inclined towards a project standard element (2) at an angle (α) and with an additional chamfered flat surface (3b) and a narrow slot is formed between both standard panel elements (5, 6) in the joint, said slot being arranged between the flat surface (3b) of the element (5) and the flat surface (3b) of the element (6) and the angular connecting profile (4) and the position of fastening holes (9) on the angular connecting profile (4) is adapted to an actual angle (10) of joining of the standard panel elements (5, 6) with each other.

4. The system according to claims 1 to 3 **characterized in that** the angle (α) is preferably between 30 and 40 degrees and the circumference (3) of both standard panel elements (5, 6) is chamfered symmetrically or asymmetrically, wherein the chamfering is preferably carried out in a way that the distance of the connecting element (4) from the project standard element (2) is as small as possible, preferably between 1 mm and 5 mm.

5. The system according to claims 1 to 4 **characterized in that** the position of the fastening holes (9) on the angular connecting profile (4) depends on the angle (10), at which two standard panel elements (5, 6) joint or connect with each other and on the distance of the angular connecting profile (4) from the project standard element (2).

6. The system according to claim 1 **characterized in that** the connecting element is a hinge joint.

7. The system according to claims 1 and 6 **characterized in that** the hinge joint is made up of two parts (14, 15), wherein each part is fastened to the standard panel element (5, 6) and an axis (17) of the hinge joint is represented by a line (16), in which two project standard elements (2) intersect, and the project standard element (2) is virtually arranged in the centre of the standard panel element (5, 6).

8. The system according to claim 1 **characterized in that** the connecting element is a flexible joint (12).

9. The system according to claims 1 and 8 **characterized in that** in the flexible joint (12) a common connecting edge (13) represents a line, in which two project standard elements (2) intersect, and a thickness (d1) of the flexible joint

(12) that equals the thickness of the two standard panel elements (5, 6) to be joined, is linearly reduced from both sides towards the common connecting edge (13) up to a thickness (d2) and the ratio between the thicknesses d2:d1 is within the range from 1:2 to 1:4, and the project standard element (2) is virtually arranged in the centre of the standard panel element (5, 6).

10. A use of the system according to claims 1 to 9 for fabricating climbing walls, for fabricating climbing wall maquettes, where a user erects a small size maquette and orders a climbing wall on this basis, and for training spatial perception.

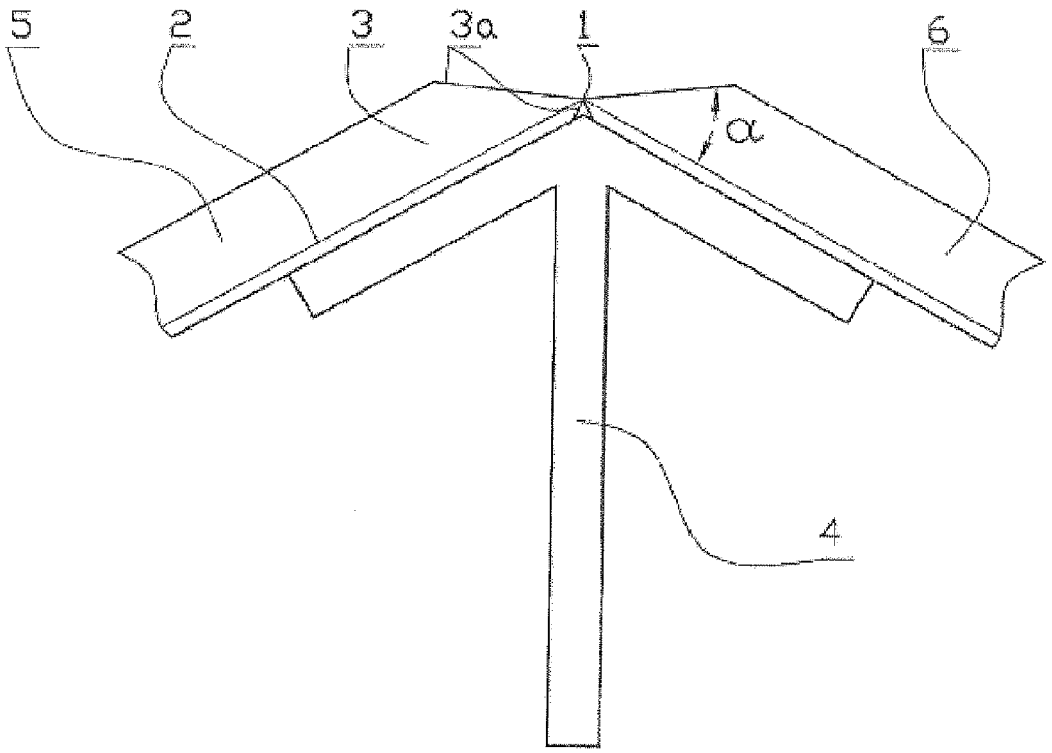

Figure 1

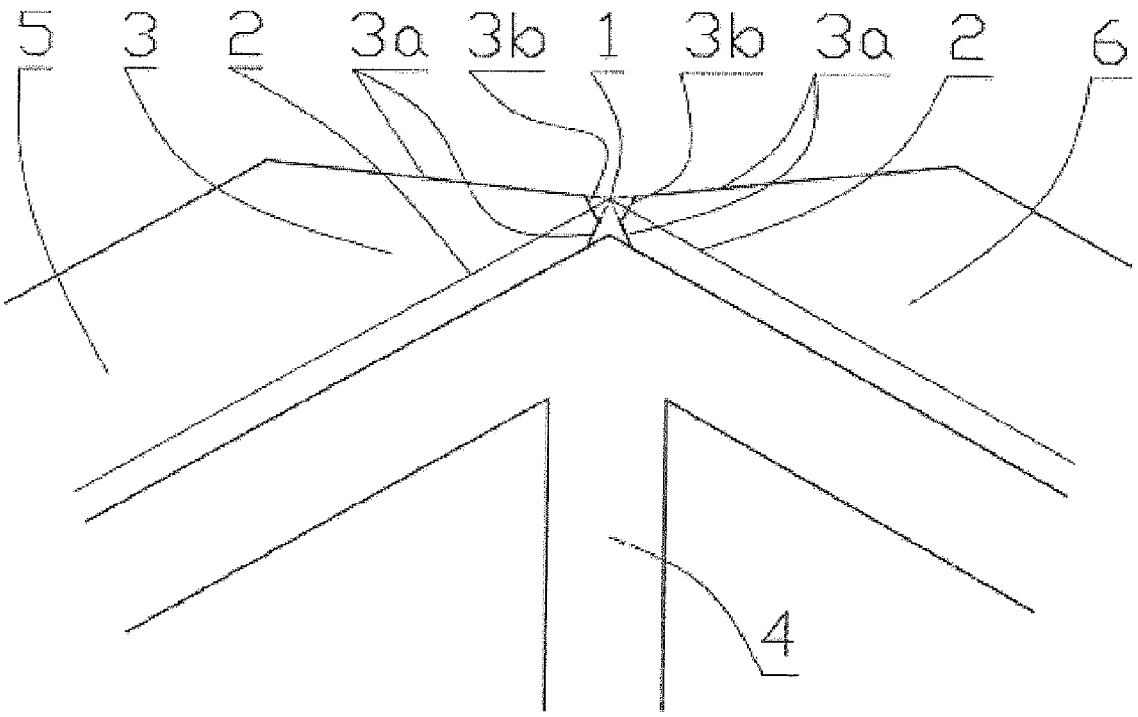

Figure 2

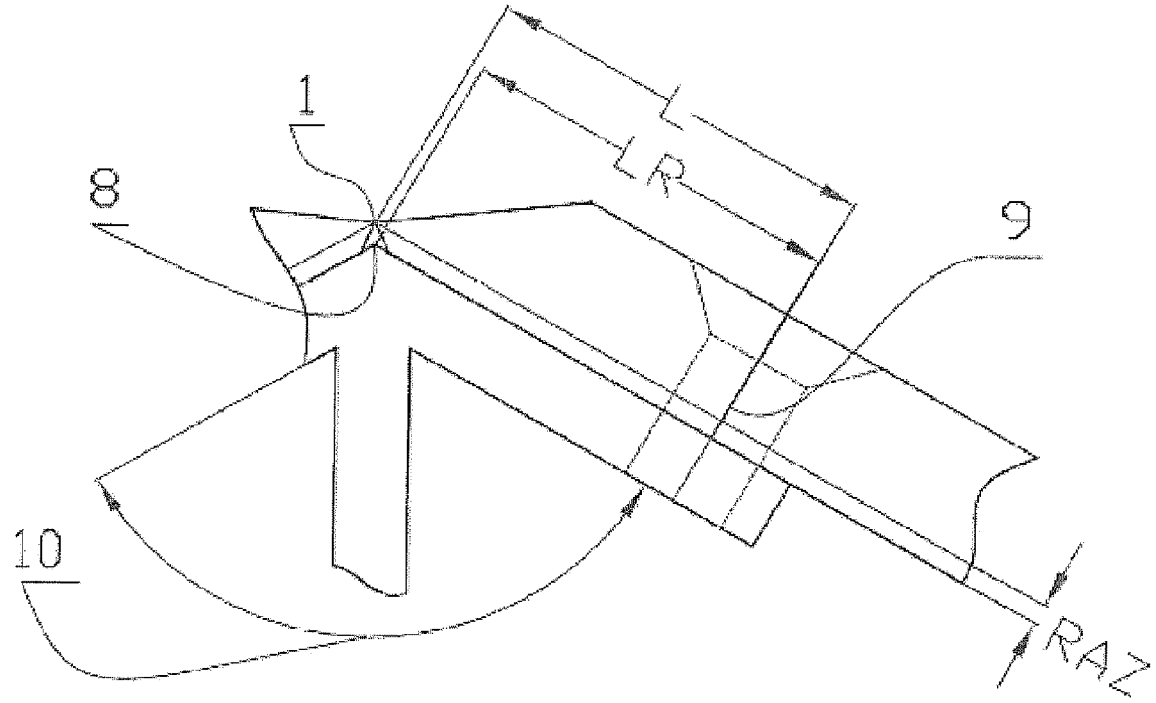

Figure 3

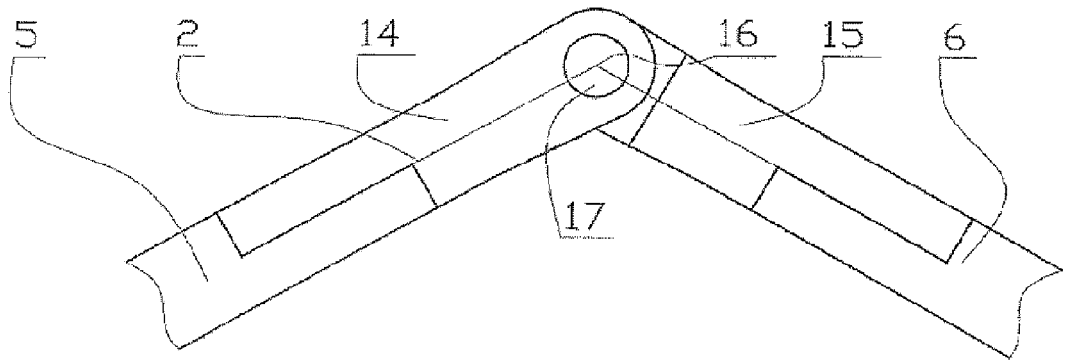

Figure 4

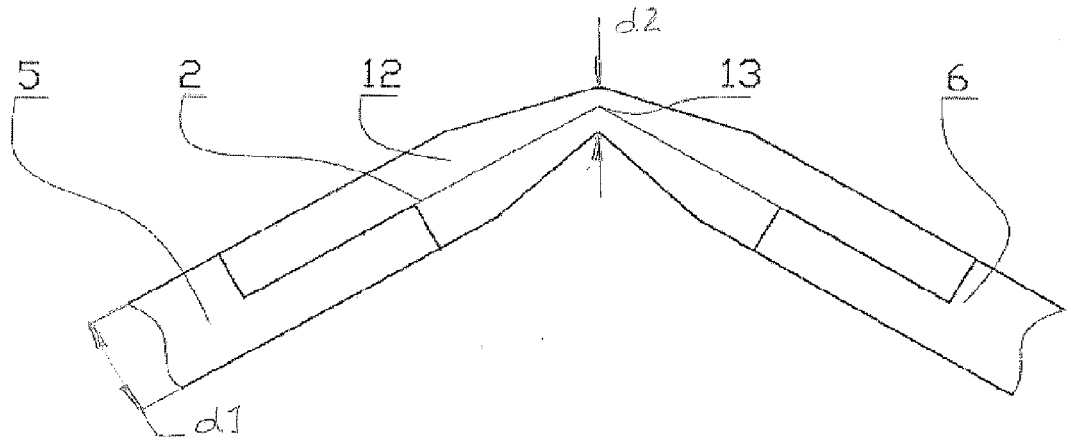

Figure 5

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EUROPEAN SEARCH REPORT

Application Number
EP 15 00 0846

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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	11 August 2015	Herry, Manuel

CATEGORY OF CITED DOCUMENTS

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