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(71) Applicant: **B1 OÜ**
11415 Tallinn (EE)

(72) Inventor: **Tiido, Indrek**
67301 Otepää vald (EE)

(74) Representative: **Käosaar, Jüri**
Käosaar & Co Patent Agency
Tähe 94
50107 Tartu (EE)

(54) **INTERLOCKING MODULAR BLOCK**

(57) The present invention relates coupling block, which has a shape of a cuboid, with four lateral surfaces (7), bottom surface (14) and upper surface (2). The coupling block (1) has at least one cylindrical through aperture (5), surrounded by the material layer forming the tenon (4), which extends over the upper surface (2) of the block (1) and the mortise (11), which is located inside the block (1) from the bottom surface (14) of the block (1). The spring element (10) forming the mortise (11) is surrounded by the lower cylindrical groove (9). The spring element (10) forming the mortise (11) has two cutouts (12), the edges of which are parallel and oriented upwards in extent of the entire spring element (10) forming the mortise, in order to enable deformation of the mortise by the value *a*, when the tenon of another coupling block is in the mortise. Coupling blocks are intended for constructing three-dimensional models.

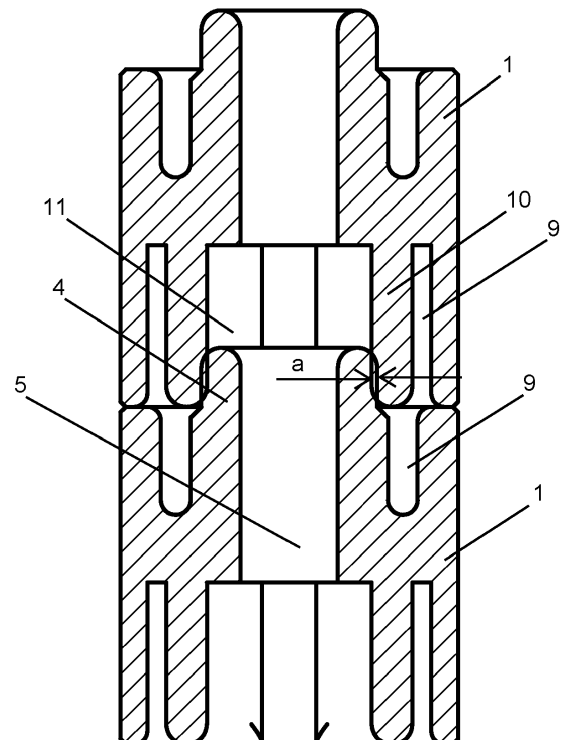


FIG 4

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a set of interlocking modular block, intended mainly for the construction of three-dimensional models. The blocks are made of wood. They can be attached one to another in a way enabling them to be detached at a later stage without the need of any tools.

BACKGROUND OF THE INVENTION

[0002] Various different construction blocks are known in the prior art, for use, for example, as children's toys. The most well-known are Lego blocks, which are made of plastic and include cylindrical plug type connection to enable detachment. Such a connection cannot be made of wood, as this would not function with wood.

[0003] In addition, construction blocks with pin type connection are known in the prior art.

[0004] For example, document WO0102073 describes construction blocks with a pin type connection, where the construction blocks have apertures for inserting and fixing the pin. The pin has an end stop for fixing and a longitudinal slot extending from the end, which is pressed together for inserting the block through the aperture, so that the stop fits through the aperture. For fixing the pin, the slot will open after passing the aperture, and the stop will remain on the other side for blocking the aperture.

[0005] Document WO9015906 describes a modular assembly essentially made up of interlocking and modular planar panels. It also includes assembly elements which can be fitted into the ends of the panels, or in lateral notches made in said panels, which make it possible to attach them one to the other, preferably in a way enabling them to be detached at a later stage. In cross-section, the panels are approximately H-shaped, forming a male connector with two branches at the lower edge of the panel, and a corresponding female connector at its upper edge. A central cavity within this section opens onto the lower edge and the two ends of the panels. Furthermore, lateral notches are set alternatively between the central cavity and one or another of the panels surfaces at regular intervals in which are fitted the L- or T-shaped assembly elements. This provides a flexible assembly of modular elements which can be used for the partitioning of drawers, for developing constructional toys, or in the fitting-out of a room or an exhibition stand.

[0006] In both mentioned documents, a physical extending stop with a triangular cross section is needed for maintaining the connection. Such a connection is not smooth and causes problems during attachment and detachment.

SUMMARY OF THE INVENTION

[0007] The object of the invention is to provide a set of

modular blocks enabling smooth coupling, ensuring a strong connection between the blocks, while enabling also smooth attachment and detachment of blocks. Such a connection is achieved, contrary to the solutions of the prior art, by pressing open the material layer surrounding the mortise, which forms the spring element, with the tenon, when the tenon enters the mortise. The spring element surrounding the mortise has two symmetric cutouts, which enable movement/deformation of the material layer. Wood fibres of the material layer are parallel to the tenon axis, enabling deformation of wood.

[0008] The characteristic ability of wood to restore its initial shape after deformation ensures a strong connection.

[0009] The coupling block has a shape of a cuboid and it has four lateral surfaces, bottom surface and upper surface. The cuboid has at least one cylindrical through aperture. The cylindrical aperture starts from the bottom surface and exits from the upper surface of the cuboid.

[0010] The cylindrical aperture has larger diameter in the lower part and forms the mortise. The diameter of the cylindrical part decreases conically in the central part of the cuboid, whereby in the upper part of the cuboid, the diameter of the cylindrical part is smaller than in the lower part.

[0011] On the upper and lower part of the cuboid, the cylindrical aperture is surrounded by a cylindrical groove, forming a cylindrical aperture around the material layer. The cylindrical groove does not reach through the cuboid, forming the upper and lower cylindrical groove. The upper and lower cylindrical groove end in the central part of the cuboid. The central part of the cylinder includes cuboid material, which is part of the cuboid and connected with the spring element.

[0012] The upper part of the cylindrical aperture with the material layer forms the tenon. The lower part of the cylindrical aperture surrounded by the spring element forms the mortise. When connecting the blocks, the tenon of one block enters the mortise formed in the lower part of the other block.

[0013] Two cutouts are made in the spring element surrounding the lower part of the cylindrical aperture, so that the cylindrical aperture is connected to the lower cylindrical groove. Edges of both cutouts are parallel and oriented upwards in extent of the entire spring element forming the mortise.

[0014] In the upper part, the cylindrical aperture is surrounded by material forming the tenon and extending over the upper surface of the cuboid. Thickness of the material surrounding the upper cylindrical aperture differs from the thickness of the material extending from the cuboid and located in the inner part of the cuboid, so that the inner part has a larger diameter. The thickness of the material layer extending over the upper surface of the cuboid is lower than thickness of the material layer extending to the upper surface of the cuboid.

[0015] The diameter of the lower part of the cylindrical aperture is less by the value a than the external diameter

of the material layer extending from the upper part of the cylindrical aperture over the upper surface of the cuboid, i.e. the tenon, forming interference fit. Interference coefficient is in the range from 1.03 to 1.06, preferably 1.05.

[0016] The material layer extending over the upper surface of the cuboid/tenon enters the lower cylindrical aperture/mortise of the other coupling block, forming mortise and tenon joint.

[0017] The coupling block is made of three-layer laminated timber, whereby in the central part of the block, the wood fibers are oriented downwards parallel to the tenon axis, and in the edges of the block, the wood fibers are perpendicular to the downwards direction. Direction of fibers in the central layer follows the vertically upwards direction of the cylindrical aperture.

[0018] Timber is a homogeneous material and the high flexibility of the material is achieved in result of external force applied on the longitudinal axis of the texture. Due to such a property of timber, the part projecting from the upper surface of the lower block will couple strongly into the lower cylindrical aperture of the block placed onto it.

LIST OF ILLUSTRATIONS

[0019] The above mentioned and other features and advantages of the present invention will be described in detail below with reference to the appended figures illustrating the preferred embodiments, where

Figure 1 is a top view of a coupling block

Figure 2 is a view of section A - A of the coupling block of Figure 1

Figure 3 is a bottom view of a coupling block

Figure 4 is a view of a section of two coupling blocks, where the tenon of the lower block is in the mortise of the upper block

Figure 5 is a side view of a coupling block, where the block has plurality of tendons.

EMBODIMENT EXAMPLE

[0020] Figure 1 is a top view of a coupling block 1 showing the upper surface 2 of the block, upper cylindrical groove 3, cylindrical aperture 5, which form the tendon 4 with the upper material layer.

[0021] Figure 2 is a view of section A - A of the coupling block 1 of Figure 1. The coupling block 1 has a cuboid shape and it has four lateral surfaces 7, bottom surface 14, and upper surface 2. The coupling block 1 has at least one through cylindrical aperture 5. The cylindrical aperture 5 starts from the bottom surface 14 and exits from the upper surface 2 of the cuboid.

[0022] The cylindrical aperture 5 has a larger diameter in the lower part than in the upper part and forms the mortise 11.

[0023] The cylindrical aperture 5 is surrounded by the cylindrical groove 3 and 9, forming a cylindrical aperture around the material layer. The cylindrical groove does

not reach through the coupling block 1, forming upper cylindrical groove 3 and lower cylindrical groove 9. Upper cylindrical groove 3 and lower cylindrical groove 9 end in the central part of the coupling block. The central part of the cylinder includes material of the coupling block 1, which is part of the cuboid and connected with the material layer surrounding the tenon 4 and the mortise 11, forming the spring element 10.

[0024] The upper part of the cylindrical aperture 5 with the material layer forms the tenon 4. The lower part of the cylindrical aperture 5 surrounded by the spring element 10 forms the mortise 11.

[0025] The upper cylindrical groove 3 is necessary for making the tenon 4 and upper part of the block 1, providing advantage during drilling for fixing the cutting blades in material.

[0026] A further task of the upper cylindrical groove 3 is to ensure that the mortise and tenon joint is free of dust and debris to enable insertion of the tenon 4 completely into the mortise 11.

[0027] Two cutouts 12 are made in the spring element 10 surrounding the lower part of the cylindrical aperture 5, so that the cylindrical aperture 5 is connected to the lower cylindrical groove 9. Edges of both cutouts 12 are parallel and oriented upwards. Stroke force of the spring element 10 depends on the size of the cutout 12. If the cutout 12 is wider, the force of the spring is weaker, while narrower cutout ensures higher force of the spring. Optimal compressive strength is determined empirically. The cutout 12 provides strength to the spring element 10. The size of a cutout is based on material, being different in the case of different timber species. It is larger in the case of species with a higher density, such as birch and beech.

[0028] The upper part of the cylindrical aperture 5 is surrounded by material forming the tenon 4 and extending over the upper surface 2 of the cuboid. The thickness of the material surrounding the upper part of the cylindrical aperture 5 differs from the thickness of the material extending from the block 1 and located in the inner part of the block 1, so that the inner part has a larger diameter. The thickness of the material layer extending over the upper surface 2 of the coupling block 1 is lower than thickness of the material layer extending to the upper surface of the cuboid by step 6.

[0029] Figure 3 is a bottom view of a coupling block 1, showing the formation of the mortise 11. The mortise 11 is formed between two material layers 10 surrounding the mortise. Material layers 11 have a curved shape and are surrounded by lower cylindrical groove 9. Material layers 11 are separated by the cutout 12. The cutout 12 is needed to ensure radial deformation of the material layers 11, when the tenon 4 is inserted into the mortise 11.

[0030] Figure 4 illustrates the connection between two coupling blocks 1, where upon connection of the blocks, the tenon 4 of one coupling block 1 enters the mortise 11 formed in the lower part of the other block 1.

[0031] The diameter of the lower part of the cylindrical

aperture 5 is less by the value a than the external diameter of the material layer extending from the upper part of the cylindrical aperture 5 over the upper surface of the cuboid, i.e. the tenon 4, forming interference fit. Interference coefficient is in the range from 1.03 to 1.06, preferably 1.05.

[0032] Figure 5 is a side view of a coupling block 1, showing that the block 1 may have plurality of tenons for coupling. All tenons are axially aligned with determined intervals to ensure the possibility of coupling with another block. The figure shows lateral surface 7, bottom surface 14, upper surface 2 of the coupling block 1, and tenons 4 located higher than the upper surface 2.

[0033] The coupling block 1 is made of three-layer laminated timber, whereby in the central part of the block 1, the wood fibers are oriented downwards along the longitudinal axis 8 of the tenon, and in the edges of the block 1, the wood fibers are perpendicular to the downwards direction. The direction of fibers in the central layer follows the vertically upwards direction of the cylindrical aperture 5. The mortise 11 and the tenon 4 with all accompanying elements are made by milling.

[0034] The blocks are designated mainly for constructing architectural models. Also for construction three-dimensional models by placing on the upper surface 2 of one block the bottom surface 14 of the other block, so that tenons 4 are aligned with mortises 11. When blocks are gently pushed, tenons 4 will enter the mortises 11 and blocks 1 are smoothly coupled to each other. In order to detach blocks 1 from each other, blocks 1 shall be pulled carefully in the direction of longitudinal axis 8. The through aperture 5 in a block enables attaching a block to another block without causing any air resistance to be overcome.

[0035] Coupling blocks 1 are designed so that they may have different number of tenons. This enables to use them for constructing various different three-dimensional models. Coupling blocks are also well suitable for use as playing blocks for children. The scope of use of the coupling blocks is broader than specified herein.

parallel and oriented upwards in extent of the entire spring element (10) forming the mortise, to enable deformation of the mortise by the value a when the tenon of another coupling block is in the mortise.

2. Interlocking modular block of claim 1, **characterised in that** the coupling block has plurality of cylindrical apertures (5), around which the tenon (4) and the mortise (11) has been formed.
3. Interlocking modular block of claim 1, **characterised in that** the coupling block (1) is made of three-layer laminated timber, whereby in the central part of the block (1) the wood fibers are oriented downwards and in the edges of the block (1) the wood fibers are perpendicular to the downwards direction.
4. Interlocking modular block of claim 1, **characterised in that** the coupling block (1) is intended for constructing three-dimensional models.

Claims

1. Interlocking modular block (1), which has a shape of a cuboid, with four lateral surfaces (7), bottom surface (14) and upper surface (2), whereby the coupling block (1) has at least one cylindrical through aperture (5), surrounded by the upper material layer forming the tenon (4), which extends over the upper surface (2) of the block (1) and the mortise (11), which is located inside the block (1) from the bottom surface (14) of the block (1), **characterised in that** the lower material layer surrounded by the lower cylindrical groove (9) forms the spring element (10) surrounding the mortise (11), whereby the spring element (10) forming the mortise (11) has two cutouts (12), the edges of which are

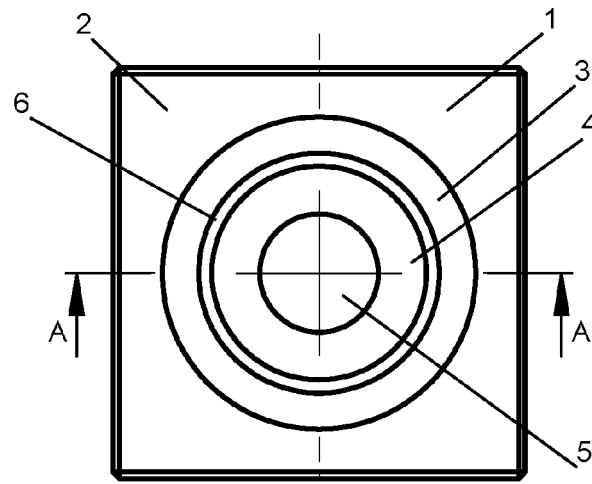


FIG 1

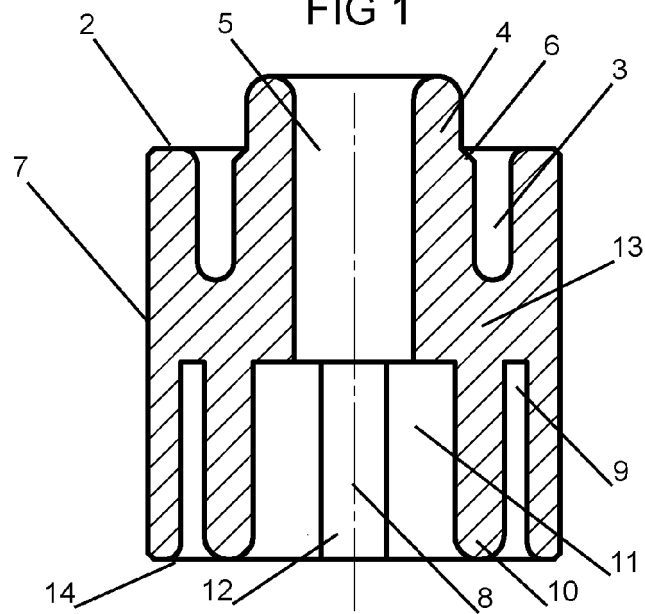


FIG 2

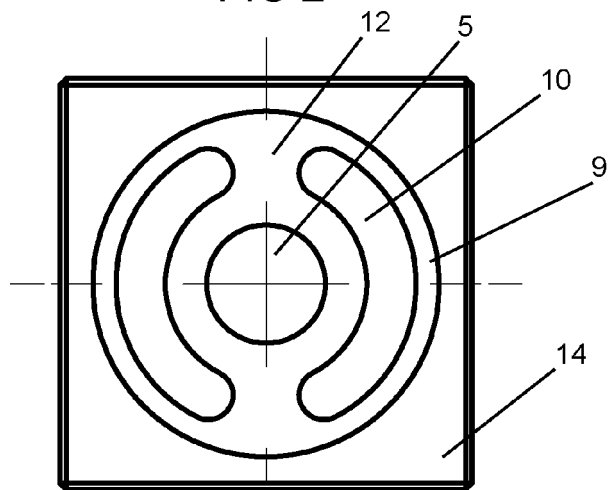


FIG 3

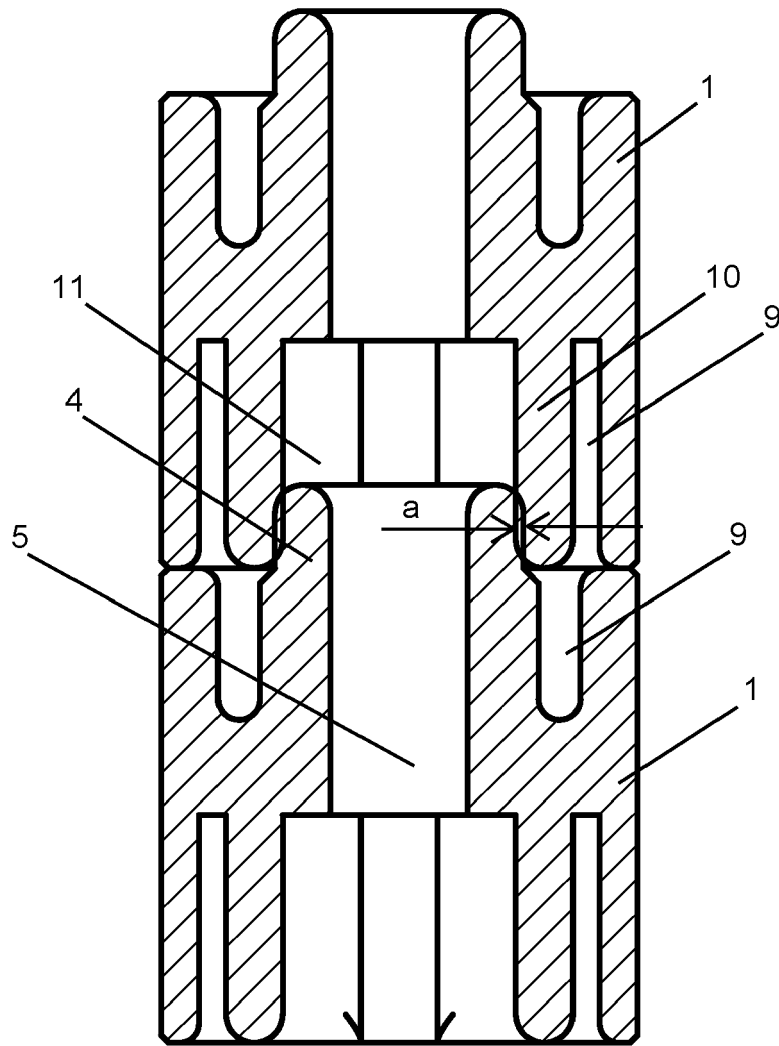


FIG 4

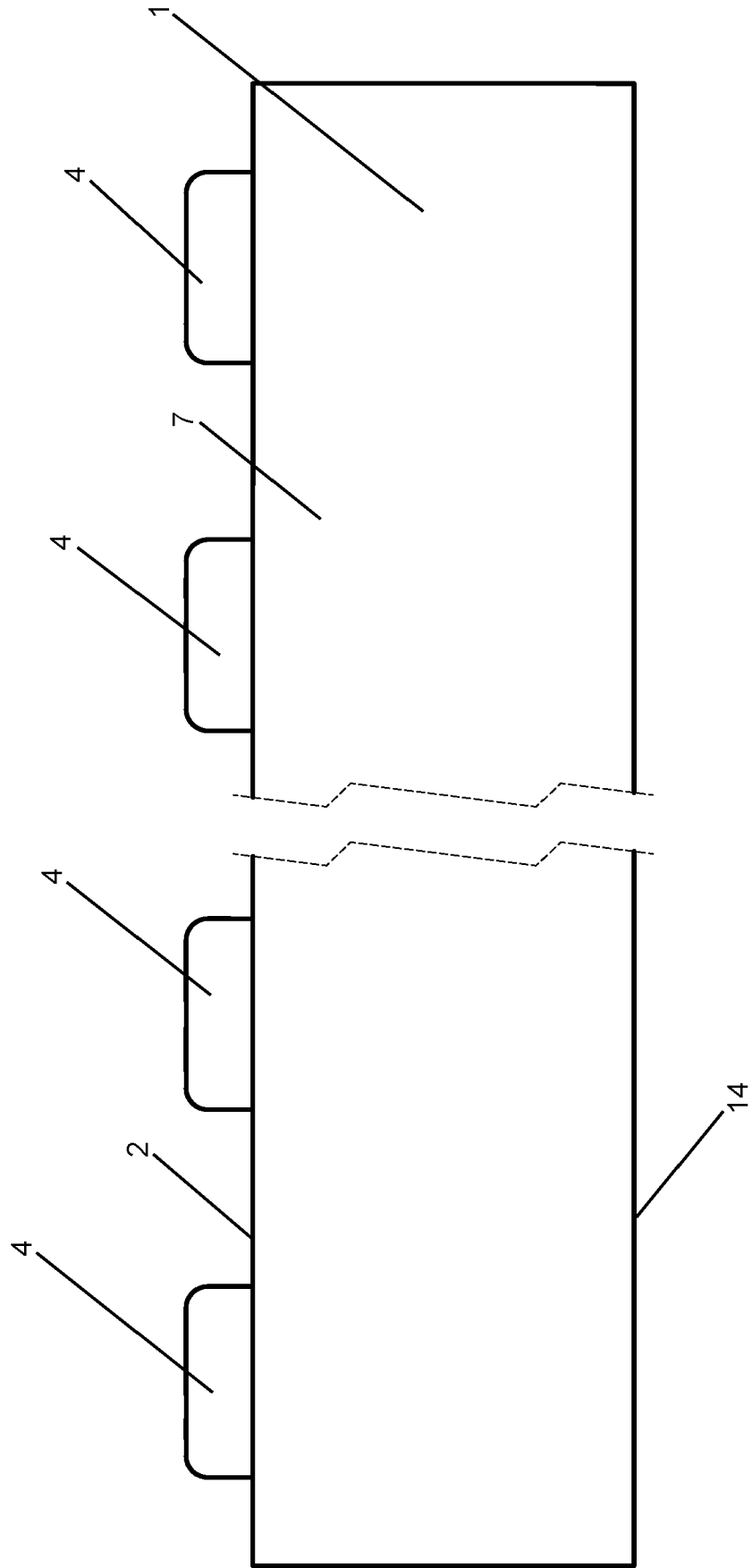


FIG 5



EUROPEAN SEARCH REPORT

Application Number
EP 20 21 4418

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EPO FORM 1503 03.82 (P04C01)

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 May 2021	Examiner Lucas, Peter
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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