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(54) ANCHORING ARRANGEMENT

(57) An anchoring arrangement (3) for anchoring a floating object (1) to a bottom of water body, characterized in that the anchoring arrangement (3) comprises a first anchor element (4) and a second anchor element (5) configured to be placed on the bottom of water body at a distance from each other, an anchor frame (6) connected to the first anchor element (4) and the second anchor element (5), a first anchor member having (7) a first end (7.1) pivotally connectable to the floating object

(1) and a second end (7.2) pivotally connected to the anchor frame (6), and a second anchor member (8) having a first end (8.1) pivotally connectable to the floating object (1) and a second end (8.2) pivotally connected to the anchor frame (6). Vertical distance between the anchor frame (6) and the first ends (7.1, 8.1) of the first anchor member (7) and the second anchor member (8) is adjustable.

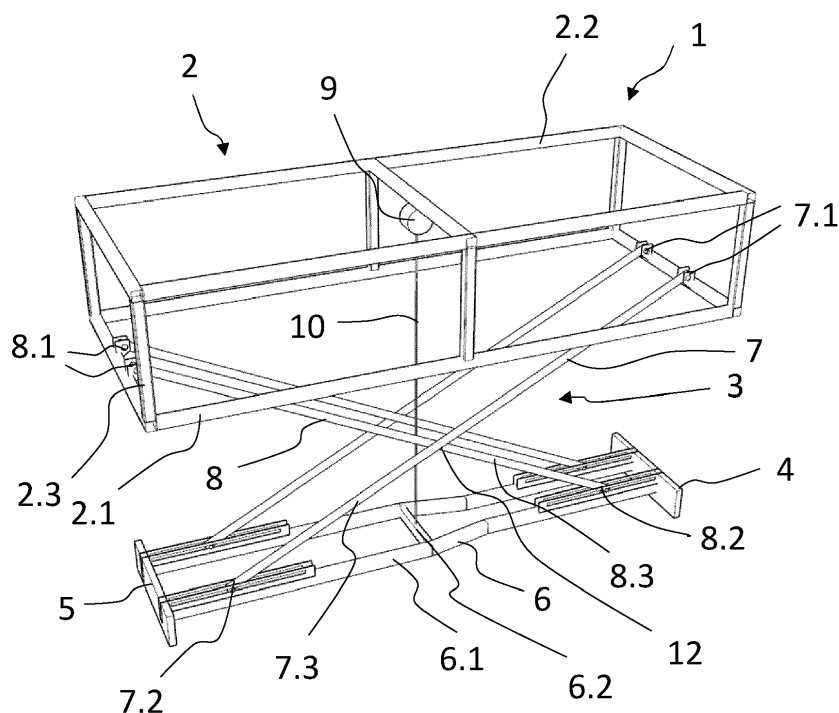


Fig. 1

Description

FIELD OF THE INVENTION

[0001] The invention relates to an anchoring arrangement according to the preamble of claim 1.

BACKGROUND OF THE INVENTION

[0002] Anchoring of floating objects, such as piers, may be costly and time-consuming. Typically, about half of the installation costs of the pier are related to the anchoring. The pier may be anchored on vertical piles driven into the bottom of the water body or by means of chains attached to the pier and weights at the bottom of the water body. Both anchoring solutions require a lot of installation work, and the use of auxiliary equipment, such as installation platform and/or pile-driver, may be necessary. Further, piers secured with chains tend to move on the water surface when the water level is low, which may be harmful.

[0003] The object of the present invention is to provide an improved anchoring arrangement for anchoring a floating object to a bottom of water body.

SUMMARY

[0004] The object of the invention can be achieved by the anchoring arrangement according to claim 1.

[0005] The anchoring arrangement according to the invention comprises a first anchor element and a second anchor element configured to be placed on the bottom of water body at a distance from each other, an anchor frame connected to the first anchor element and the second anchor element, a first anchor member having a first end pivotally connectable to the floating object and a second end pivotally connected to the anchor frame, and a second anchor member having a first end pivotally connectable to the floating object and a second end pivotally connected to the anchor frame. Vertical distance between the anchor frame and the first ends of the first anchor member and the second anchor member is adjustable.

[0006] Significant benefits can be achieved by the means of the invention. By means of the anchoring arrangement according to the invention vertical distance between the floating object and the anchor frame placed on the bottom of the water body can be automatically adjusted when the water level varies. Thus, the floating object can be kept at a desired position on the water surface.

[0007] In one embodiment of the invention, the second end of the first anchor member and the second end of the second anchor member are movable/slidable along the anchor frame towards and away from each other.

[0008] In one embodiment of the invention, the first end of the first anchor member and the first end of the second anchor member are movable towards and away from

each other.

[0009] In one embodiment of the invention, the first anchor member and/or the second anchor member are configured to extend and retract in their longitudinal direction.

[0010] In one embodiment of the invention, the first end of the first anchor member is located horizontally closer to the second end of the second anchor member than the first end of the second anchor member, and the first end of the second anchor member is located horizontally closer to the second end of the first anchor element than the first end of the first anchor element.

[0011] In one embodiment of the invention, the first anchor member and the second anchor member are tilted towards each other so that they intersect each other.

[0012] In one embodiment of the invention, the first end of the first anchor member and the second end of the second anchor member are located on one side of an intersection of the first anchor member and the second anchor member, and the first end of the second anchor member and the second end of the first anchor member are located on the opposite side of the intersection.

[0013] In one embodiment of the invention, the second end of the first anchor member is pivotally connected to the anchor frame between the second anchor element and the second end of the second anchor member, and the second end of the second anchor member is pivotally connected to the anchor frame between the first anchor element and the second end of the first anchor member.

[0014] In one embodiment of the invention, the anchor frame comprises at least two parallel connecting bars arranged at a distance from each other, the first ends of the connecting bars being attached to the first anchor element and the second ends of the connecting bars being attached to the second anchor element.

[0015] In one embodiment of the invention, the first anchor member comprises at least two anchor bars arranged at a distance from each other, first ends of the first anchor bars being pivotally connectable to the floating object and the second ends of the first anchor bars being pivotally connected to the anchor frame.

[0016] In one embodiment of the invention, the second anchor member comprises at least two parallel second anchor bars arranged at a distance from each other, first ends of the second anchor bars being pivotally connectable to the floating object and the second ends of second the anchor bars being pivotally connected to the anchor frame.

[0017] In one embodiment of the invention, the anchoring arrangement is provided with a lifting mechanism configured to lift the anchor elements and the anchor frame against the floating object and lower the anchor elements and the anchor frame to the bottom of the water body.

[0018] In one embodiment of the invention, the anchor frame comprises at least one lower slide along which the second end first anchor member and the second end of the second anchor member are configured to slide toward and away from each other.

[0019] In one embodiment of the invention, the anchor-

ing arrangement comprises at least one upper slide along which the first end of the first anchor member and the first end of the second anchor member are configured to slide toward and away from each other, the at least one upper slide being connectable to the floating object.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] In the following the invention will be described in detail by means of examples with reference to the accompanying drawings, in which

Fig. 1 shows a floating object having an anchoring arrangement in an anchoring position,

Fig. 2 shows the floating object of fig. 1 having the anchoring arrangement in a lifted position

DETAILED DESCRIPTION

[0021] Figs. 1 and 2 show an anchoring arrangement 3 according to an embodiment of the invention for anchoring a floating object 1 to a bottom of water body. The anchoring arrangement 3 is connected to the floating object 1. The floating object 1 may be a pier or pier module, as shown in the drawings, that may be used as a mooring and/or a storage platform for boats. The pier module 1 may be a part of a pier that comprises a plurality of pier modules 1 connected together.

[0022] The pier module comprises a frame 2 having a lower frame part 2.1 and an upper frame part 2.2. The lower and upper frame parts may be rectangular. The lower frame part 2.1 and the upper frame part 2.2 are arranged one on top of the other and at a distance from each other in the vertical direction. The frame 2 further comprises connecting posts 2.3 that connect the lower frame part 2.1 and the upper frame part 2.2 to each other. The connecting posts 2.3 are located at least at the corners of the frame parts 2.1, 2.2. The frame 2 comprises at least one float which may be located within the frame 2, for example between the frame parts 2.1, 2.2. The pier module may comprise a deck placed above the float (s). The deck is attached to the frame 2, typically to the upper frame part 2.2.

[0023] The floating object 1, such as the pier module 2, comprises an anchoring arrangement 3 for anchoring the object 1 to the bottom of the water body. The anchoring arrangement 3 comprises a first anchor element 4 and a second anchor element 5 configured to be placed on the bottom of the water body at a distance from each other. The anchor elements 4,5 may be anchor weights. The anchor elements 4, 5 may be made of reinforced concrete or steel. The anchor elements 4,5 may comprise friction elements that prevent the sliding of the anchor elements 4,5 along the bottom of the water body.

[0024] The anchoring arrangement 3 further comprises an anchor frame 6 connected to the first anchor element 4 and the second anchor element 5. The anchor

frame 6 may comprise at least two parallel connecting bars 6.1 that are arranged at a distance from each other. The connecting bars 6.1 are connected by at least one transverse bar 6.2. The first ends of the connecting bars 6.1 are attached to the first anchor element 4 and the second ends of the connecting bars 6.1 are attached to the second anchor element 5.

[0025] The anchoring arrangement 3 further comprises a first anchor member 7 having a first end 7.1 pivotally connectable/connected to the floating object 1, e.g. to the bottom of the floating object 1, and a second end 7.2 pivotally connected to the anchor frame 6. The first anchor member 7 may comprise one or more first anchor arms or anchor bars 7.3. The first end 7.1 and the second end 7.2 of the first anchor member 7 are arranged to pivot around transverse pivot axes. The transverse pivot axes are perpendicular to the longitudinal direction of the first anchor member 7.

[0026] The anchor arrangement 3 further comprises a second anchor member 8 having a first end 8.1 pivotally connectable/connected to the floating object 1, e.g. to the bottom of the floating object 1, and a second end 8.2 pivotally connected to the anchor frame 6. The second anchor member 8 may comprise one or more second anchor arms or anchor bars 8.3. The first end 8.1 and the second end 8.2 of the second anchor member 8 are arranged to pivot around transverse pivot axes. The transverse pivot axes are perpendicular to the longitudinal direction of the second anchor member 8. The transverse pivot axes of the first anchor member 7 and the second anchor member 8 are parallel.

[0027] The first anchor member 7 and the second anchor member 8 are tilted towards each other so that they intersect each other. Thus, the first end 7.1 of the first anchor member 7 and the second end 8.2 of the second anchor member 8 are located on one side of the intersection 12 of the first anchor member 7 and the second anchor member 8, and the first end 8.1 of the second anchor member 8 and the second end 7.2 of the first anchor member 7 are located on the opposite side of the intersection 12.

[0028] The first end 7.1 of the first anchor member 7 and the first end 8.1 of the second anchor member 8 are pivotally connected to the floating object 1 at a distance from each other. The second end 7.2 of the first anchor member 7 and the second end 8.2 of the second anchor member 8 are pivotally connected to the anchor frame 6 at a distance from each other.

[0029] The vertical distance between the anchor frame 6 and the floating object 1/first ends 7.1, 8.1 of the anchor members 7,8 is automatically adjustable. The first end 7.1 of the first anchor member 7 and the first end 8.1 of the second anchor member 8 may be movable, e.g. slidable, along the floating object 1, e.g. the bottom of the floating object 1, toward and away from each other. The first end 7.1 of the first anchor member 7 and the first end 8.1 of the second anchor member 8 are configured to move/slide along floating object 1 toward each other

when the vertical distance between the anchor frame 6 and the floating object 1 increases. Respectively, the first end 7.1 of the first anchor member 7 and the first end 8.1 of the second anchor member 8 are configured to move/slide along floating object 1 away from each other when the vertical distance between the anchor frame 6 and the floating object 1 increases. and decreases. Thus, the vertical distance between the anchor frame 6 and the floating object 1 can be adjusted.

[0030] The anchoring arrangement 3 or the floating object 1 may comprise at least one upper slide along which the first ends 7.1, 8.1 of the first and the second anchoring members are configured to slide. The upper slide is attachable/attached to the floating object 1.

[0031] Alternatively or additionally, for adjusting the vertical distance between the anchor frame 6 and the floating object 1/the first ends 7.1, 8.1 of the first anchor member 7 and the second anchor member 8, the second end 7.2 of the first anchor member 7 and the second end 8.2 of the second anchor member 8 may be movable, e.g. slidable, along the anchor frame 6 toward and away from each other. The second end 7.2 of the first anchor member 7 and the second end 8.2 of the second anchor member 8 are configured to move/slide along anchor frame 6 toward each other when the vertical distance between the anchor frame 6 and the floating object 1 increases. Respectively, the second end 7.2 of the first anchor member 7 and the second end 8.2 of the second anchor member 8 are configured to move/slide along anchor frame 6 away from each other when the vertical distance between the anchor frame 6 and the floating object 1 decreases. The anchor frame 6 may comprise at least one lower slide along which the second ends 7.2, 8.2 are configured to slide. Alternatively or additionally, the first anchor member 7 and the second anchor member 8 may be telescopic. Thus, the anchor members 7, 8 are configured to extend when the vertical distance between the floating object 1 and the anchor frame 6 increases and retract when the vertical distance between the floating object 1 and the anchor frame 6 decreases. The first anchor member 7 and the second anchor member 8 are configured to extend and retract in their longitudinal direction.

[0032] The first end 7.1 of the first anchor member 7 is located horizontally closer to the second end 8.2 of the second anchor member 8 than the first end 8.1 of the second anchor member 8. Further, the first end 8.1 of the second anchor member 8 is located horizontally closer to the second end 7.2 of the first anchor member 7 than the first end 7.1 of the first anchor member 7.

[0033] The second end 7.2 of the first anchor member 7 is pivotally connected to the anchor frame 6 between the second anchor element 5 and the second end 8.2 of the second anchor member 8. The second end 8.2 of the second anchor member 8 is pivotally connected to the anchor frame 6 between the first anchor element 4 and the second end 7.2 of the first anchor element 7.

[0034] When the water level rises, the second end 7.2

of the first anchor member 7 and the second end 8.2 of the second anchor member 8 move/slide along the anchor frame 6 toward each other if the second ends 7.2, 8.2 are configured to move/slide along the anchor frame 6. Alternatively or additionally, the first end 7.1 of first anchor member 7 and the first end 8.1 of the second anchor member 8 move/slide toward each other if the first ends 7.1, 8.1 are configured to move/slide. Alternatively or additionally, if the anchor members 7, 8 are telescopic, the anchor members 7, 8 extend. Thus, the vertical distance between the floating object 1 and the anchor frame 6 increases.

[0035] When the water level drops, the first and/or second ends of the first and second anchor members 7, 8 move/slide in opposite directions, i.e. away from each other. If the anchor members 7, 8 are telescopic, the anchor members 7, 8 retract. Thus, the vertical distance between the floating object 1 and anchor frame 6 decreases.

[0036] The floating object 1 may comprise two anchor spaces 11 configured to receive and store the anchor elements 4, 5. The anchor spaces 11 may be located within the floating object 1.

[0037] The floating object 1 or the anchoring arrangement 3 may further comprise a lifting mechanism 9, such as a winch, configured to lift and lower the anchor elements 4, 5 and the anchor frame 6. The lifting device 9 is configured to lift the anchor elements 4, 5 from the bottom of water body against the bottom of the floating object 1, e.g. into the anchor spaces 11, and lower the anchor elements 4, 5 to the bottom of the water body.

[0038] During the transport and installation of the floating object 1, the anchor elements 4, 5 are placed in the anchor spaces 11 and detachably attached to the floating object 1. The floating object 1 may comprise transport supports by which the anchor elements 4, 5 are supported and held in place in the anchor spaces 11 during the transport and installation of the floating object 1. The transport support can comprise a bar that extends over the opening of anchor space 11.

[0039] It is obvious to a person skilled in the art that with the advancement of technology, the basic idea of the invention may be implemented in various ways. The invention and its embodiments are thus not limited to the examples described above, instead they may vary within the scope of the claims.

Claims

1. An anchoring arrangement (3) for anchoring a floating object (1) to a bottom of water body, **characterized in that** the anchoring arrangement (3) comprises:

- a first anchor element (4) and a second anchor element (5) configured to be placed on the bottom of water body at a distance from each other,

- an anchor frame (6) connected to the first anchor element (4) and the second anchor element (5),
 - a first anchor member having (7) a first end (7.1) pivotally connectable to the floating object (1) and a second end (7.2) pivotally connected to the anchor frame (6),
 - a second anchor member (8) having a first end (8.1) pivotally connectable to the floating object (1) and a second end (8.2) pivotally connected to the anchor frame (6), and
 - wherein vertical distance between the anchor frame (6) and the first ends (7.1, 8.1) of the first anchor member (7) and the second anchor member (8) is adjustable.
2. The anchoring arrangement (3) according to claim 1, **characterized in that** the second end (7.2) of the first anchor member (7) and the second end (8.2) of the second anchor member (8) are movable/slidable along the anchor frame (6) towards and away from each other.
 3. The anchoring arrangement (3) according to claim 1 or 2, **characterized in that** the first end (7.1) of the first anchor member (7) and the first end (8.1) of the second anchor member (8) are movable towards and away from each other.
 4. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** the first anchor member (7) and/or the second anchor member (8) are configured to extend and retract in their longitudinal direction.
 5. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** the first end (7.1) of the first anchor member (7) is located horizontally closer to the second end (8.2) of the second anchor member (8) than the first end (8.1) of the second anchor member (8), and the first end (8.1) of the second anchor member (8) is located horizontally closer to the second end (7.2) of the first anchor element (7) than the first end (7.1) of the first anchor element (7).
 6. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** the first anchor member (7) and the second anchor member (8) are tilted towards each other so that they intersect each other.
 7. The anchoring arrangement (3) according to claim 6, **characterized in that** the first end (7.1) of the first anchor member (7) and the second end (8.2) of the second anchor member (8) are located on one side of an intersection (12) of the first anchor member (7) and the second anchor member (8), and the first end (8.1) of the second anchor member (8) and the second end (7.2) of the first anchor member (7) are located on the opposite side of the intersection (12).
 8. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** the second end (7.2) of the first anchor member (7) is pivotally connected to the anchor frame (6) between the second anchor element (5) and the second end (8.2) of the second anchor member (8), and the second end (8.2) of the second anchor member (8) is pivotally connected to the anchor frame (6) between the first anchor element (4) and the second end (7.2) of the first anchor member (7).
 9. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** the anchor frame (6) comprises at least two parallel connecting bars (6.1) arranged at a distance from each other, the first ends of the connecting bars (6.1) being attached to the first anchor element (4) and the second ends of the connecting bars (6.1) being attached to the second anchor element (5).
 10. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** the first anchor member (7) comprises at least two anchor bars (7.3) arranged at a distance from each other, first ends of the first anchor bars (7.3) being pivotally connectable to the floating object (1) and the second ends of the first anchor bars (7.3) being pivotally connected to the anchor frame (6).
 11. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** the second anchor member (8) comprises at least two parallel second anchor bars (8.3) arranged at a distance from each other, first ends of the second anchor bars (8.3) being pivotally connectable to the floating object (1) and the second ends of second the anchor bars (8.3) being pivotally connected to the anchor frame (6).
 12. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** the anchoring arrangement (3) is provided with a lifting mechanism (9) configured to lift the anchor elements (4, 5) and the anchor frame (6) against the floating object (1) and lower the anchor elements (4, 5) and the anchor frame (6) to the bottom of the water body.
 13. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** anchor frame (6) comprises at least one lower slide along which the second end (7.2) first anchor member (7) and the second end (8.2) of the second anchor member are configured to slide toward and away from each other.

14. The anchoring arrangement (3) according to any of the preceding claims, **characterized in that** anchoring arrangement (3) comprises at least one upper slide along which the first end (7.1) of the first anchor member (7) and the first end (8.1) of the second anchor member (8) are configured to slide toward and away from each other, the at least one upper slide being connectable to the floating object (1). 5
15. A floating object (1), such as a pier module (2), **characterized in that** the floating object (1) comprises an anchoring arrangement (3) according to any of the preceding claims 1 to 14, and the first end (7.1) of the first anchor member (7) and the first end (8.1) of the second anchor member (8) being pivotally connected to the floating object (1) at a distance from each other. 10 15

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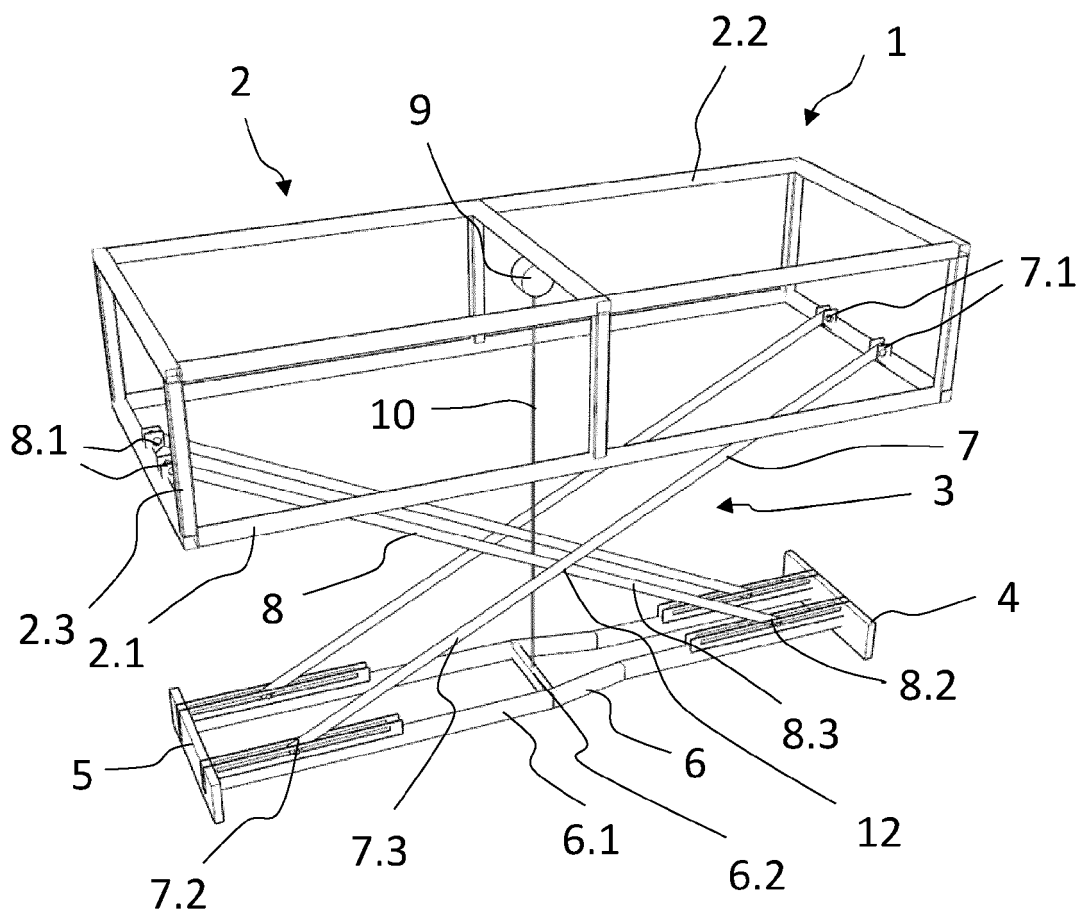


Fig. 1

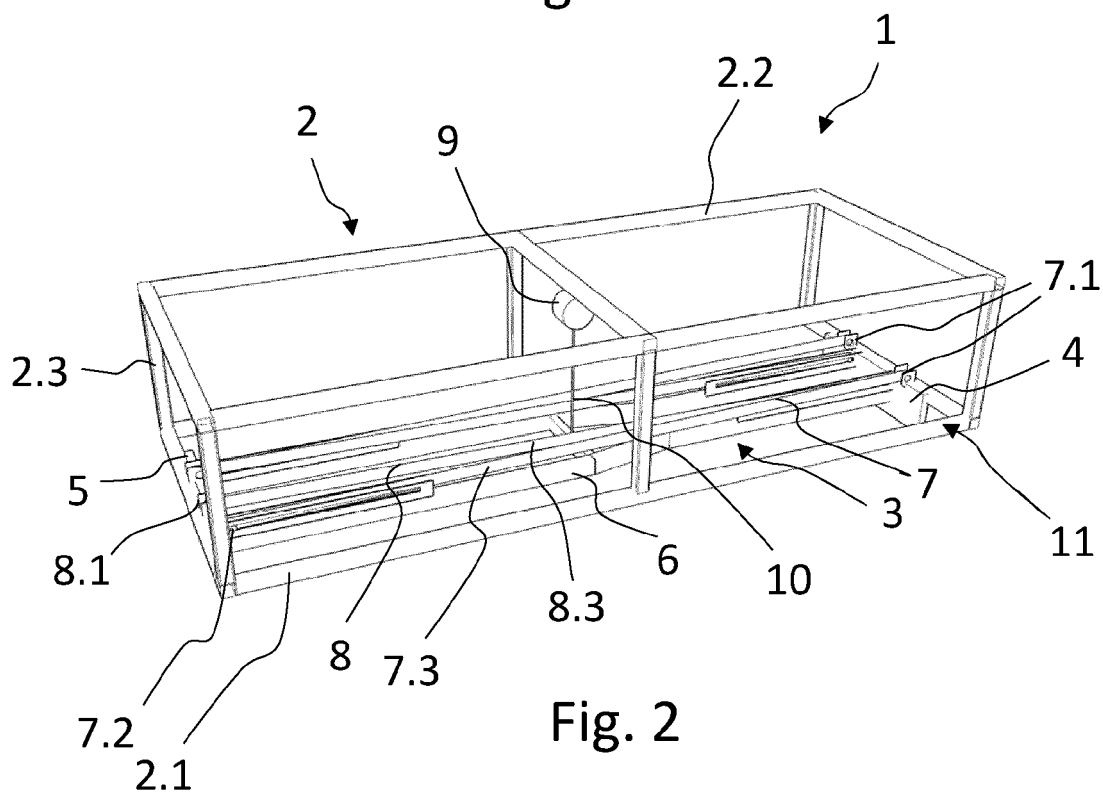


Fig. 2



EUROPEAN SEARCH REPORT

Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	ES 2 388 621 A1 (UNIV VIGO [ES]) 17 October 2012 (2012-10-17) * the whole document *	1, 10, 11, 15	INV. E02B3/06
X	US 2007/166110 A1 (KENADY STEPHEN M [US]) 19 July 2007 (2007-07-19) * paragraph [0061] - paragraph [0065]; figures *	1, 10, 11, 15	
A	US 5 107 784 A (LACY FRANKLIN R [US]) 28 April 1992 (1992-04-28) * claims; figures *	1, 15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E02B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 February 2022	Examiner Fordham, Alan
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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.
The members are as contained in the European Patent Office EDP file on
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21-02-2022

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82