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(71) Applicant (for all designated States except US): **AKER  
SUBSEA AS** [NO/NO]; P.O.Box 94, NO-1325 Lysaker  
(NO).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **OMVIK, Sigvard**  
[NO/NO]; Tronvikveien 17, NO-1517 Moss (NO).

(74) Agent: **PROTECTOR IP CONSULTANTS AS**; Os-  
carsgate 20, NO-0352 Oslo (NO).

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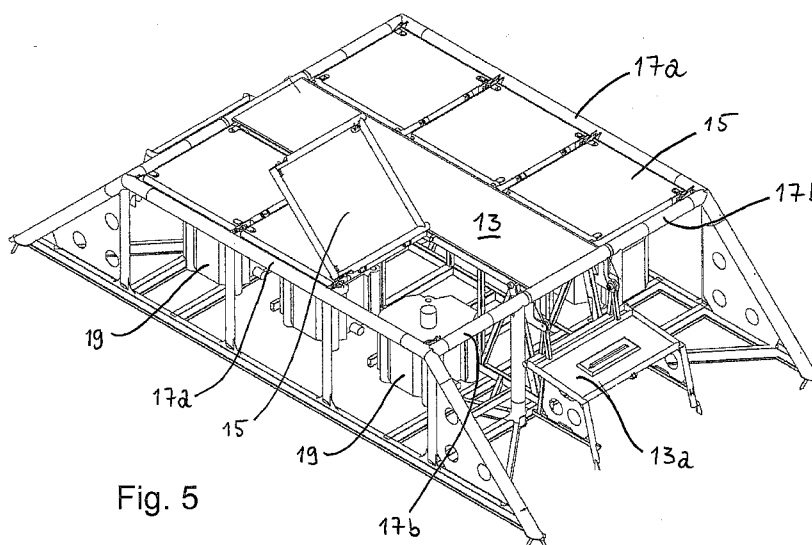


Fig. 5

(57) Abstract: Well template (11) for the protection of equipment for wells on the sea bed, comprising outer, upper template parts (17a, 17b) and flippable protection hatches (15) which, in a closed position, protect well slots. The protection hatches (15) are mounted so that they can flip up about two non-parallel flip axes.

## **Well template and method for use thereof**

The present invention relates to a template for a well for the protection of equipment for wells on the sea bed. The invention relates in particular to protection hatches in such a template.

### **Background**

Arranging well templates over underwater wells to protect the well equipment against the surroundings is known. This relates in particular to protection against catch equipment for fish, such as a trawl, and also equipment that can fall down from, for example, well installations, such as chains or other heavy equipment. The well templates are solid constructions which may have a shape that allows a trawl to glide across them without getting stuck. On the top side of the well template there are normally requirements to arrange hatches over every well slot. It must be possible to remove the hatches from their location above the wells so that other equipment can be connected from above, for example, a blow-out preventer (BOP). For this purpose, hatches that can be flipped up and away from the position above the well head are known.

Well templates that are placed over several well heads are known. The patent NO 323495 shows a well template comprising flippable hatches for access to equipment under the hatches, where a receiving area for a manifold is arranged between the hatches.

For example, well templates with four well slots are known, whereby a manifold is placed between the well slots in such way that it has two well slots on either side. Such a well template is shown in figure 1. The hatches are then set up to flip up about an axis perpendicular to the longitudinal extension of the manifold. In this way an ROV will have access to the valve tree or other equipment from the side of the valve tree which is opposite to the manifold, at the same time as the hatch is open.

In the lowering of the manifold between the two pairs of well slots all four of the hatches, for one such well template for four well slots, will be flipped away from the well slot to give space for the manifold as it is lowered down. When the hatches are flipped up into this position, the upper part of the well template will thus display a large opening with space for the manifold during lowering or lifting up.

To illustrate a problem with a well template with more than four well slots, one can visualise a corresponding well template with six or more well slots. Here, three or more well slots will be arranged on either side of an extended manifold. One will then appreciate that the between-lying hatches can not be flipped up about an axis that lies perpendicular to the longitudinal extension of the manifolds as a part of the hatch will then be in the way of the manifold for the lowering (or raising) of this. Furthermore, the template to which a between-lying hatch is fastened to will also be in the way.

One solution will therefore be to flip up all the hatches about an axis which is in parallel with the longitudinal extension of the manifold. A such axis could possibly be placed along the outer and upper edge of the well template, in parallel with the longitudinal extension of the manifold. Furthermore, all the hatches on the same side of the manifold would have to be fastened to each other (or only one hatch) as there would be no space for structures to support the between-lying hatches in a closed position. Such structures would come in the way of the manifold during the lowering or raising. However, such a solution would result in problems for the access to the valve trees for a remote controlled underwater vessel (ROV). The hatches would then be flipped up from the well template, in the direction away from the manifold. When the blow-out preventer (BOP) stands on the valve tree, its manoeuvring panels shall be located directly opposite each other to ease the access to them for the ROV and to allow a cable connection and hydraulic connection between the blow-out preventer and the valve tree. This is a detachable connection that runs between the manoeuvring panels. A well template with four well slots will therefore, with

a known technology, not be able to be expanded to, for example, six or eight well slots.

It is an aim of the present invention to provide a well template with flippable hatches that can be installed over four or more well slots.

### **The invention**

In accordance with a first aspect of the invention, a well template is provided for protection of equipment for wells on the sea bed, comprising outer, upper template parts and flippable protection hatches, which protect well slots when in a closed position. The protection hatches are mounted so that they can be flipped up about two non-parallel flip axes. This solution results in flexibility for the application of the well template, which will be explained below. In particular this is relevant at the installation and raising of a manifold and at the use of a remote controlled underwater vessel (ROV).

The well template in accordance with the first aspect of the present invention can conveniently be comprised of two, in the main, parallel rows of well slots, where each row comprises at least two well slots. A number of protection hatches are placed over each row, of which at least some of the hatches are mounted in an adjoining protection hatch so that they can be flipped up.

In one embodiment of the first aspect of the invention the well template conveniently comprises two, in the main, parallel rows of well slots with at least three well slots in each row. An assigned protection hatch is placed over each well slot, whereby the protection hatches that are arranged between two adjoining protection hatches are mounted in at least one of these adjoining protection hatches so that they can be flipped up. When the protection hatches are flipped up away from the other area of the well template, there will be no remaining support structure or template structure for the protection hatches.

In a special embodiment of the first aspect of the invention, each protection hatch is set up to be flipped up about two non-parallel flip axes and groups of adjoining protection hatches can be flipped up together about one of the flip axis which is common for the protection hatches in one such group. However, one can also imagine an embodiment where individual protection hatches can be flipped up about the common flip axis, while the adjoining protection hatches remain in a closed position.

At least one of the protection hatches is preferably set up to be placed in an open position, whereby it lies on top of an adjoining protection hatch. This will be useful in the lowering and raising of the well template in water, as fewer closed protection hatches will result in a reduced resistance in the water ("added mass").

The protection hatches can, in the main, extend horizontally in a closed position, where they are, in the main, lying level with a manifold structure or a protection plate for protection of this, arranged between two rows of well slots.

In accordance with a second aspect of the invention a method is provided for installation and/or operation of equipment for wells on the sea bed. The method encompasses the following steps:

- (i) setting up a well template with a number of protection hatches on the sea bed, said well template comprises a number of well slots and an area to receive a longitudinally extending manifold;
- (ii) flipping up a group of protection hatches about a first flip axis, in the main, in parallel with the longitudinal extension of the manifold, away from the area that will receive a manifold, with the protection hatches being mounted so that they can flip up about the first flip axis;
- (iii) installing a manifold in said area;
- (iv) during use of a remote controlled underwater vessel on equipment on one of said well slots, such as a valve tree, setting up the protection hatch over said well slot in an open position flipped up about a second

flip axis perpendicular to said first flip axis, with the protection hatches also being mounted so that they can flip up about the second flip axis. A further advantage with the present invention is that the well template can be made smaller than known corresponding well templates, as there is no need for a support structure to support the protection hatches in the area inside the upper, outer template parts that form the upper periphery of the well template. Thereby the protection hatches can be arranged close to the receiving area for a manifold without the available area necessary for the raising and lowering of the manifold becoming reduced.

Yet another advantage of the present invention is that, at the same time as the manifold is installed, pipe covers can be installed that are wider than the manifold. This is because the pipe cover will not collide with the protection hatches when these are flipped up away from the area of the manifold.

### **Example**

With essential features of the invention being described above, a more detailed example description will be given in the following with reference to the figures, in which:

- Fig 1. is a perspective view of a well template according to prior art with four well slots;
- Fig 2. is a perspective view of a well template according to the invention comprising six well slots and with a manifold about to be lowered in place in the well template;
- Fig. 3 shows the same well template as in figure 2, but with the manifold in place;
- Fig. 4 is a top view of the well template shown in figure 2;
- Fig. 5 is a perspective view of the well template with valve trees installed in the well slots;
- Fig. 6 is a perspective view of the well template with a blow-out preventer placed in one of the well slots;

- Fig. 7 is a side view of the well template in accordance with the invention, where two between-lying protection hatches are flipped up about an adjoining protection hatch to reduce the water resistance;
- Fig. 8 is a top view of the well template shown in figure 7;
- Fig. 9 is a perspective view of the well template in accordance with the invention;
- Fig. 10 is a detailed section of a hatch hinge and a template hinge in position, given by X in figure 9;
- Fig. 11 is the same detail section as shown in figure 10, but with both protection hatches in closed position; and
- Fig. 12 is a detailed section of support brackets for support of the protection hatches in closed position.

Figure 1 shows a known well template 1 with four well slots. Two pairs with two well slots are arranged on either side of an extended manifold 3. As it can be seen in figure 1, the well template has a protection hatch 5 arranged over each well slot. These can be flipped up about an upper and outer template part 7, about an axis which lies perpendicular to the longitudinal extension of the manifold. When all four of the protection hatches 5 are flipped up, the manifold 3 can be lowered in place or be raised without the hatches being in the way. The well templates are fastened to four suction anchors 9 that hold the well template 1 in place on the sea bed.

Figure 2 shows a well template 11 according to the invention, as a manifold 13 is about to be lowered into the well template 11. The well template 11 comprises six well slots. A protection hatch 15 is placed over each well slot so that the well template 11 comprises six protection hatches 15. As can be seen in figure 2, the well slots are divided into two rows of three well slots. The protection hatches 15 are configured in the same way. The rows run in parallel with the longitudinal axis of the manifold 13. To make room for the lowering of the manifold 13 between the two rows of well slots, all the protection hatches 15 are flipped up away from the position of the manifold, that is, away from the

area between the two rows of well slots. In the two rows of protection hatches 15, the three respective protection hatches 15 are fastened to each other in such a way that they flip up together about an axis that is on the opposite side of, and in parallel with, the longitudinal extension of the manifold 13, so that they flip up away from the manifold. This axis is in parallel with, and orientated almost, at an outer and upper template part 17a that runs in parallel with the longitudinal axis of the manifold 13.

Figure 3 shows the same well template 11 as shown in figure 2, but with the manifold 13 in place between the rows of well slots. The manifold 13 has a pipe cover 13a at each end that can be flipped in place as shown in figure 5. The pipe cover 13a is set up to protect the sea bed pipelines (not shown) that stretch out from the ends of the manifold 13. Figure 5 shows the pipe cover when it is installed.

Figure 4 shows the well template 11 seen from above, with all the protection hatches 15 flipped up about the axis parallel with the longitudinal axis of the manifold 13. As can be seen in figure 4, there is no upper, inner part of the template construction in the area of the manifold 13. The only parts of the well template 11 are the outer, upper template parts 17a and 17b that stretch in parallel to and perpendicular to, respectively, the longitudinal axis of the manifold 13. (The upper template parts 17a are not shown in figure 17, as the protection hatches 15 lie over them).

Figure 5 shows the well template 11 with valve trees 19 installed in the well slots. In the situation depicted in figure 5, only one of the protection hatches 15 is opened. Contrary to the situation shown in the figures 2 to 4, the protection hatch 15 is flipped up about an axis that runs perpendicularly to the longitudinal extension of the manifold 13. Therefore, it will not protrude over the area of the well template 11. A remote controlled underwater vessel (ROV) (not shown) has access to the associated valve tree 19 from the side of the well template 11 that runs in parallel with the longitudinal axis of the manifold 13. Because of the flip

direction of the protection hatch 15, the hatch will not come in the way of cables and lines that extend up from the underwater vessel. It shall be noted that the flipped up protection hatch 15 is flipped up about the hinges in the adjoining protection hatch 15.

Figure 6 shows the well template 11 with a blow out preventer 21 placed in a between-lying well slot. This well slot is arranged between two adjoining well slots. Corresponding to the protection hatch 15 shown in figure 5, the flipped up protection hatch 15 shown in figure 6 is also flipped up about an axis perpendicular to the longitudinal extension of the manifold 13. Thus, the protection hatch 15 does not protrude outside the top area of the well template 11.

The figures 7 and 8 show the well template 11 seen from the side and from above, respectively. Here, the well template 11 is shown with two of its six protection hatches 15 flipped up and down against an adjoining protection hatch 15. When looking at figure 8, one can see that the protection hatches 15 only cover four of the six well slots. This configuration is advantageous in the lowering and raising of the well template 11 in water, as it results in a reduced resistance in the water ("added mass") than if all the protection hatches 15 were closed. If the protection hatches 15 had been flipped up about the axis in parallel with the longitudinal extension of the manifold, they would not have reduced their effective area and thus not reduced the resistance in the water.

Figure 9 shows the well template 11 in figure 7 and figure 8 in a perspective diagram. Figure 10 is a detailed section of figure 9, in the area given by X and shows a hinge 23 in more detail. Here, a first protection hatch 15 is flipped up over a second protection hatch 15. A double bracket 25 extends into the well template 11 from the upper template part 17a. The bracket 25 has support grooves 27 to receive support bolts 29 that protrude out from each protection hatch 15. In closed position, the protection hatch 15 rests on the double bracket 25 in this support groove 27.

When the first protection hatch 15 is flipped over a second protection hatch 15, as shown in figure 9 and figure 10, the first protection hatch 15 is hinged to the second with a pair of hatch hinges 31. A hatch hinge bracket 33 that extends into the hatch hinge 31 of the second protection hatch 15 is fastened to the first protection hatch 15. The hatch hinge bracket 33 is detachably fastened in the hatch hinge 31. When the first protection hatch 15 (or any of the protection hatches) is to be flipped up separately about an axis in parallel with the upper and outer template part 17a (in parallel with the longitudinal extension of the manifold), the hatch hinge bracket 33 is released from the hatch hinge 31. If all the adjoining protection hatches 15 are to be flipped up about the upper and outer template part 17a, the hatch hinge bracket 33 remains fastened to the hatch hinge 31.

When the hatch hinge bracket 33 is released from the hatch hinge 31, the protection hatch 15 can flip up about the frame hinges 35 fastened to the upper and outer template part 17a. In this position, a hinge pin 37 extends into a hinge hole 39 arranged in the double bracket 25 (figure 10).

Figure 11 shows a detailed section from the same place as shown in figure 10, but with all the protection hatches 15 closed.

Figure 12 shows a detailed section of the position given with reference number XII in figure 9. A plate 41, arranged for the protection of the area which shall receive the manifold, is fitted with support brackets 43 to receive a protruding outer part of the protection hatches 15 that face this area. Only one protection hatch 15 is shown in figure 12. However, the support bracket 43 can receive two such outer parts to support two protection hatches 15. In the installation or raising of the manifold, the plate 41 will be removed, and as mentioned above, the protection hatches 15 will be flipped up into an open position about a flip axis, in the main, running parallel with the longitudinal extension of the manifold, in the template hinges 35.

The plate 41 can also be a permanently fitted roof of the manifold 13. Alternatively, supports 43 can be placed directly on another part of the manifold, which provide support in the same position.

The description of the example given here is only included to explain and make clear one embodiment, and advantages with the invention. The extent of the present invention is given in the claims. Therefore, a person skilled in the art will understand that the invention comprises several different embodiments.

Claims

1. Well template (11) for protection of equipment for wells on the sea bed, comprising outer, upper template parts (17a, 17b) and flippable protection hatches (15) which, in a closed position, protect well slots, **characterised in** that the protection hatches (15) are mounted so that they can flip open about two non-parallel flip axes.
2. Well template (11) according to claim 1, further comprising two mainly parallel rows of well slots, whereby each row comprises at least two well slots, where a number of protection hatches (15) are arranged over each row, **characterised in** that at least some of the protection hatches (15) are mounted in an adjoining protection hatch (15) so that they can flip open.
3. Well template (11) according to claim 1, **characterised in** that it comprises two mainly parallel rows of well slots with at least three well slots in each row and that placed over each well slot is an assigned protection hatch (15), whereby the protection hatches (15) arranged between two adjoining protection hatches (15) are mounted in at least one of these adjoining protection hatches (15) so that they can flip open.
4. Well template (11) according to one of the preceding claims, **characterised in** that each protection hatch (15) is set up to flip up about two non-parallel flip axes and that groups of adjoining protection hatches (15) can be flipped up simultaneously about one of the flip axis which is common for the protection hatches (15) in a such group.
5. Well template (11) according to one of the preceding claims, **characterised in** that at least one of the protection hatches (15) is set up to be placed in an open position, whereby it lies on top of an adjoining protection hatch (15).

6. Well template (11) according to one of the preceding claims,  
**characterised in** that the protection hatches (15) are mainly horizontal when in a closed position, whereby they lie, in the main, level with an upper part of a manifold (13) arranged between two rows of well slots.

7. Method for installing and/or operating equipment for wells on the sea bed,  
**characterised by**

- (i) arranging a well template (11) with a number of protection hatches (15) on the sea bed, said well template (11) comprises a number of well slots and an area to receive a manifold (13) that extends longitudinally;
- (ii) flipping up a group of protection hatches (15) about a first flip axis mainly in parallel with the longitudinal extension of the manifold (13), away from the reception area for a manifold (12), with the protection hatches (15) being mounted so that they can flip up about the first flip axis;
- (iii) installing a manifold (13) in said area:
- (iv) during use of a remote controlled underwater vessel on equipment such as a valve tree (19) in one of said well slots, arranging the protection hatch (15) to said well slot in an open position flipped up about a second flip axis perpendicular to said first flip axis, as the protection hatches (15) are also mounted so that they can flip up about the second flip axis.

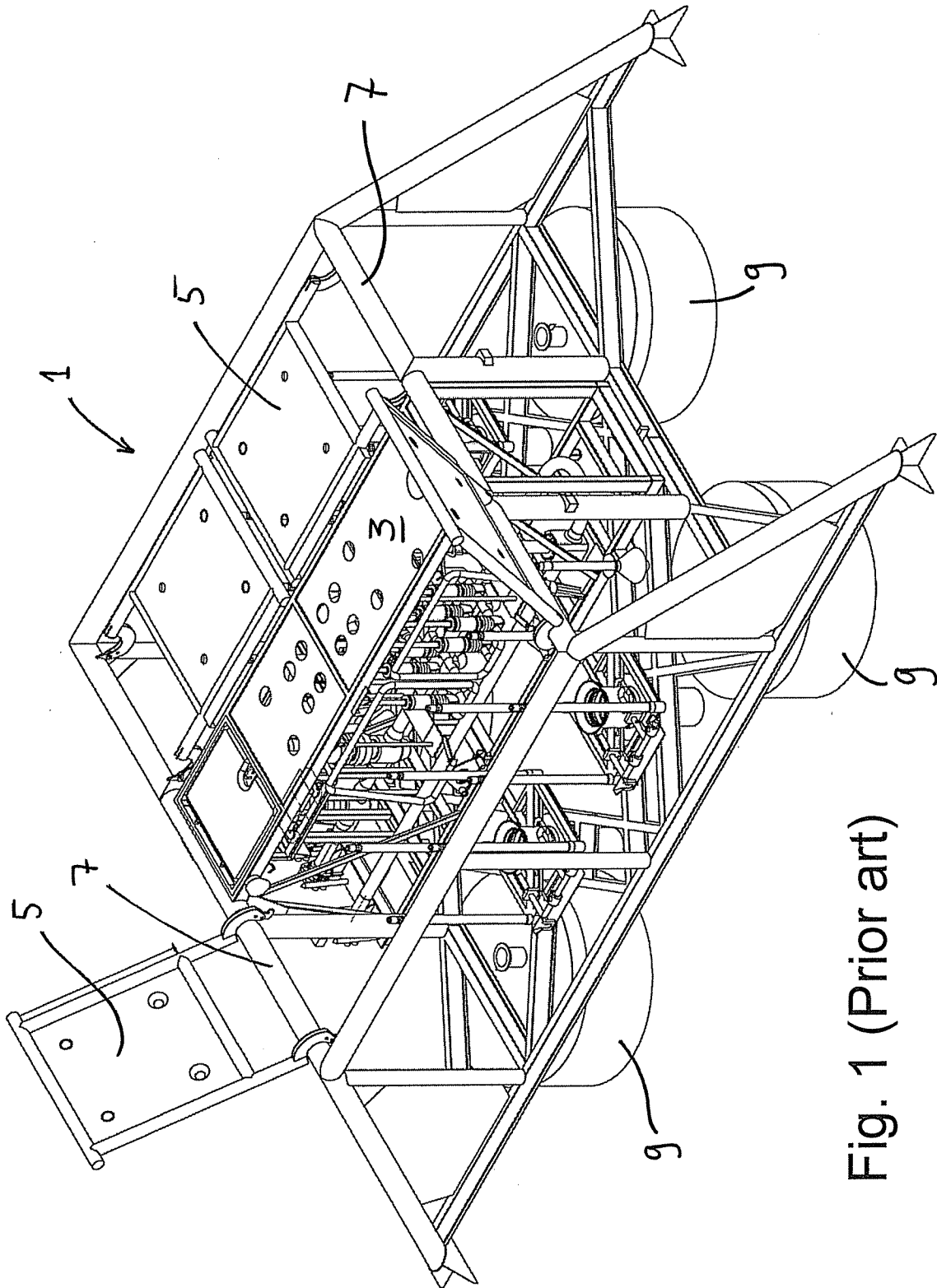
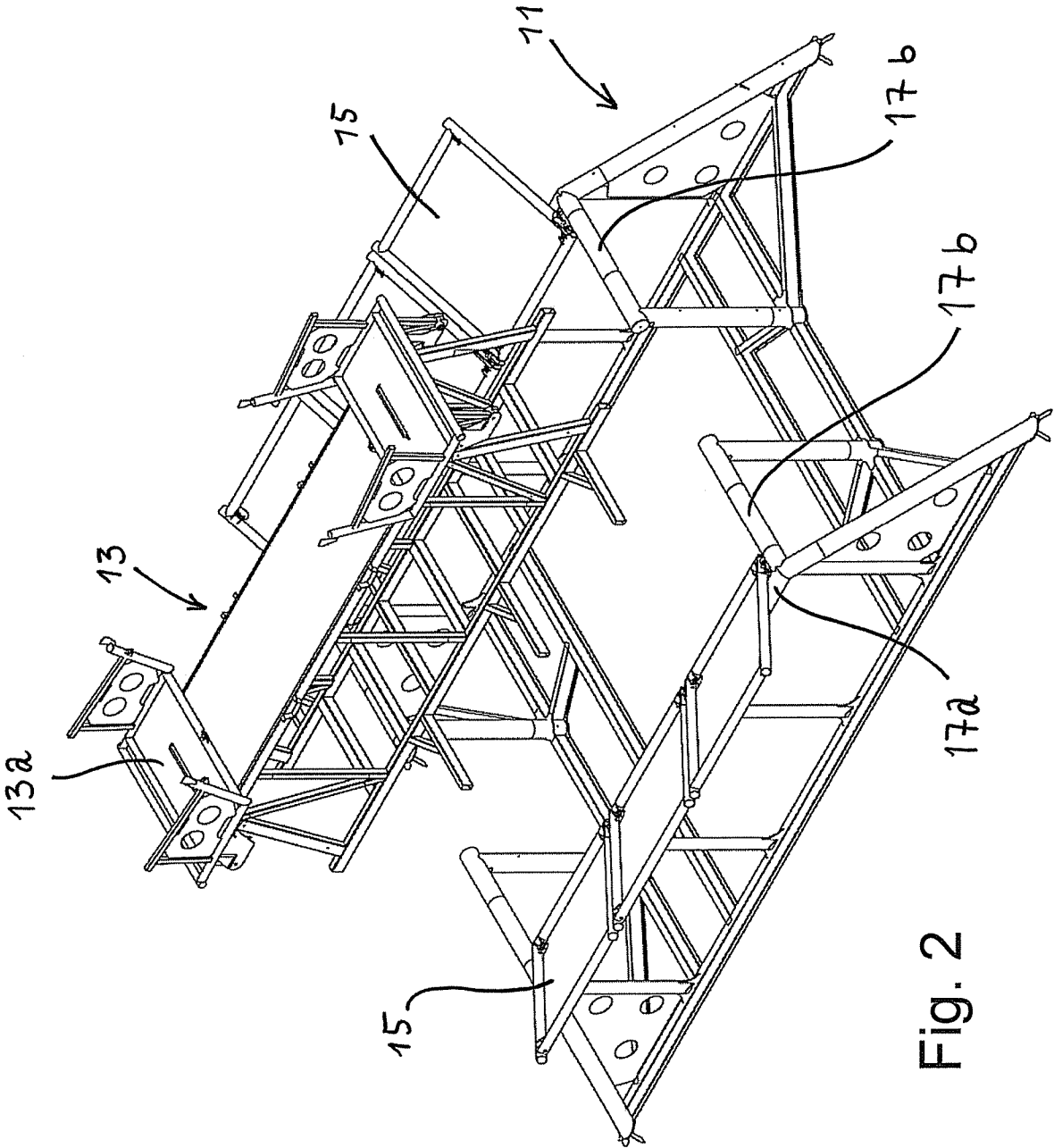


Fig. 1 (Prior art)



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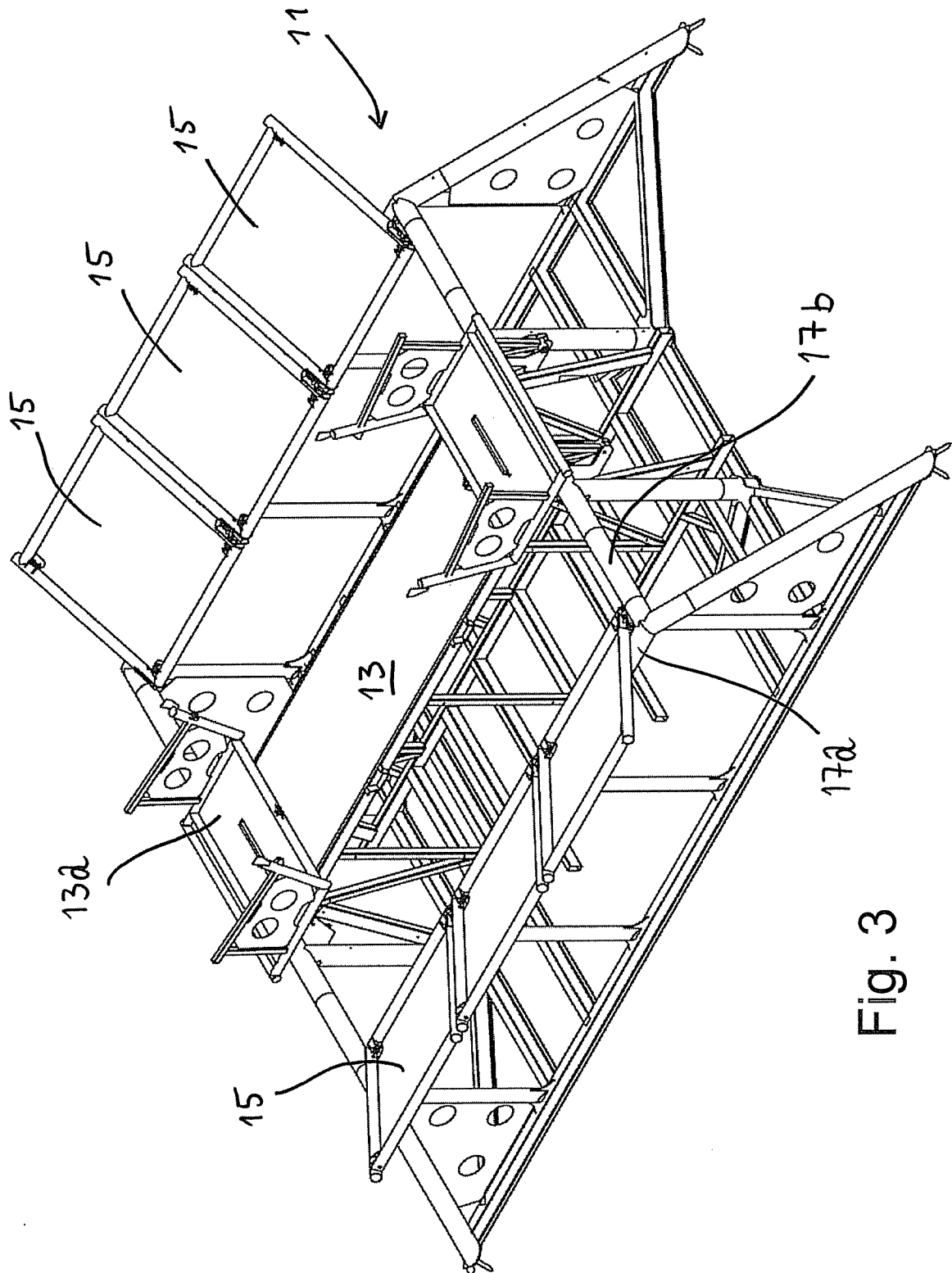


Fig. 3

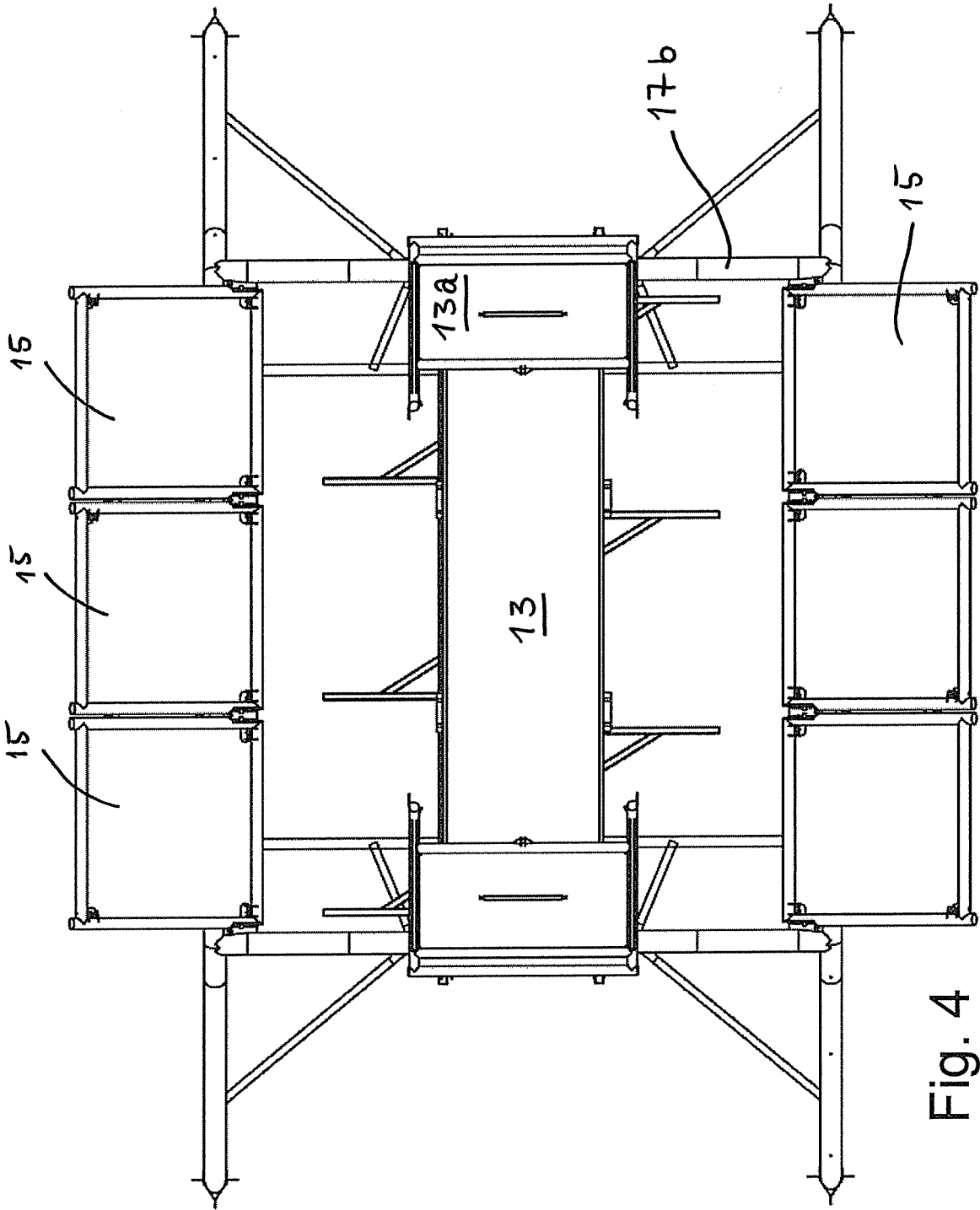


Fig. 4

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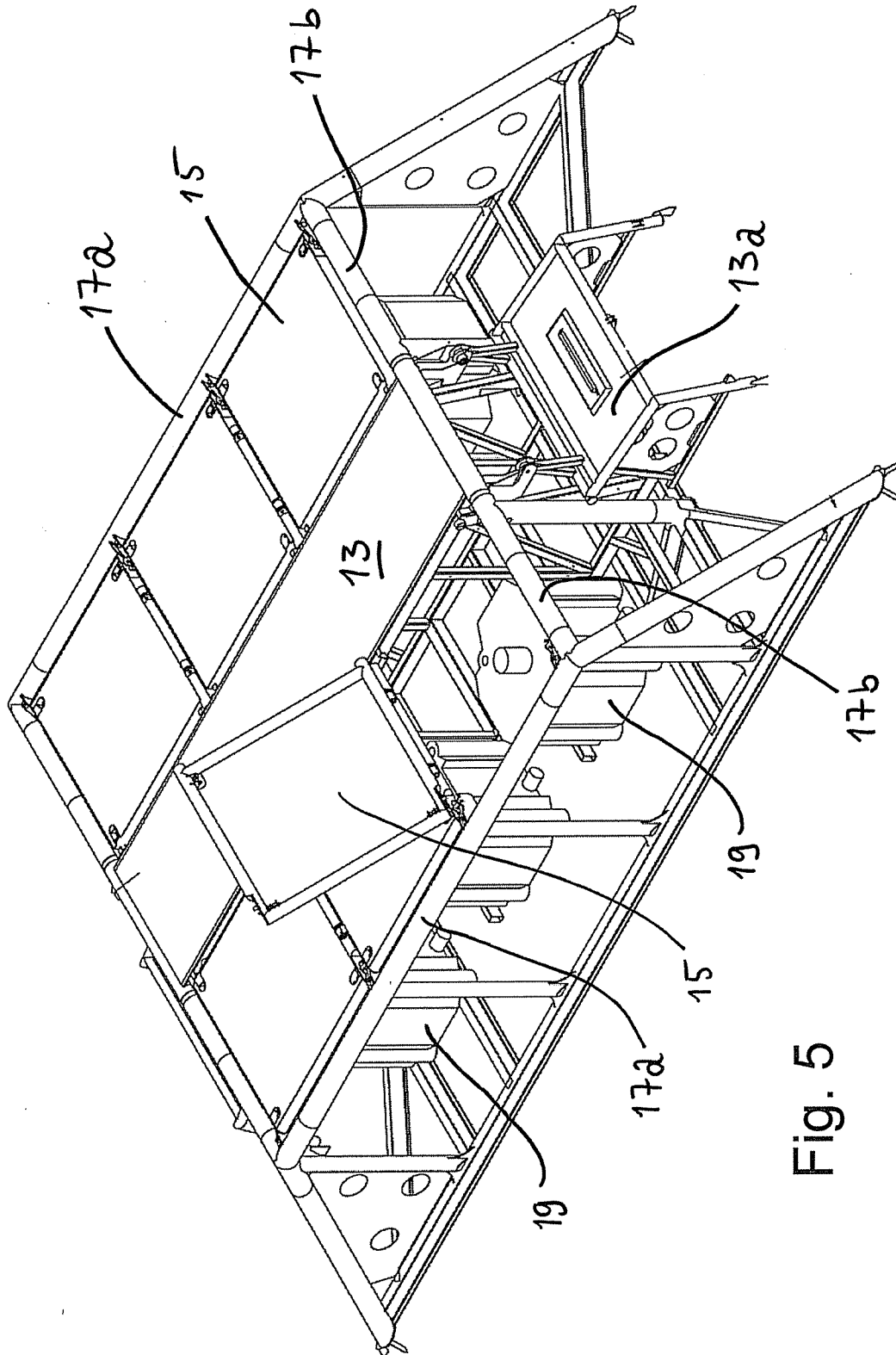


Fig. 5

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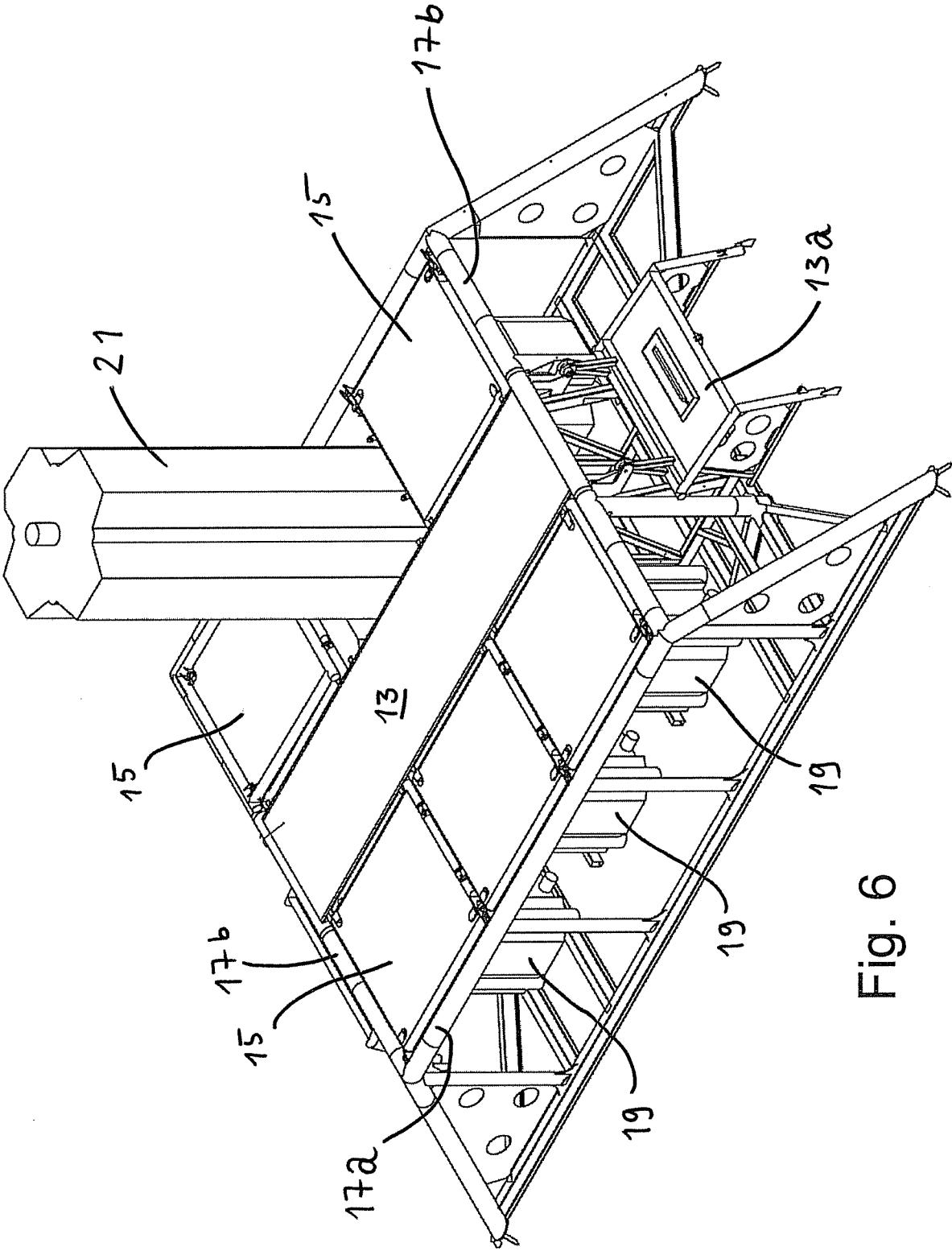


Fig. 6

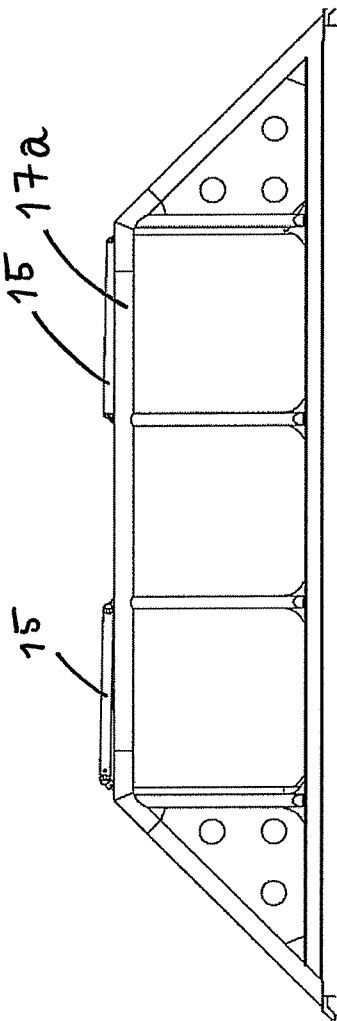


Fig. 7

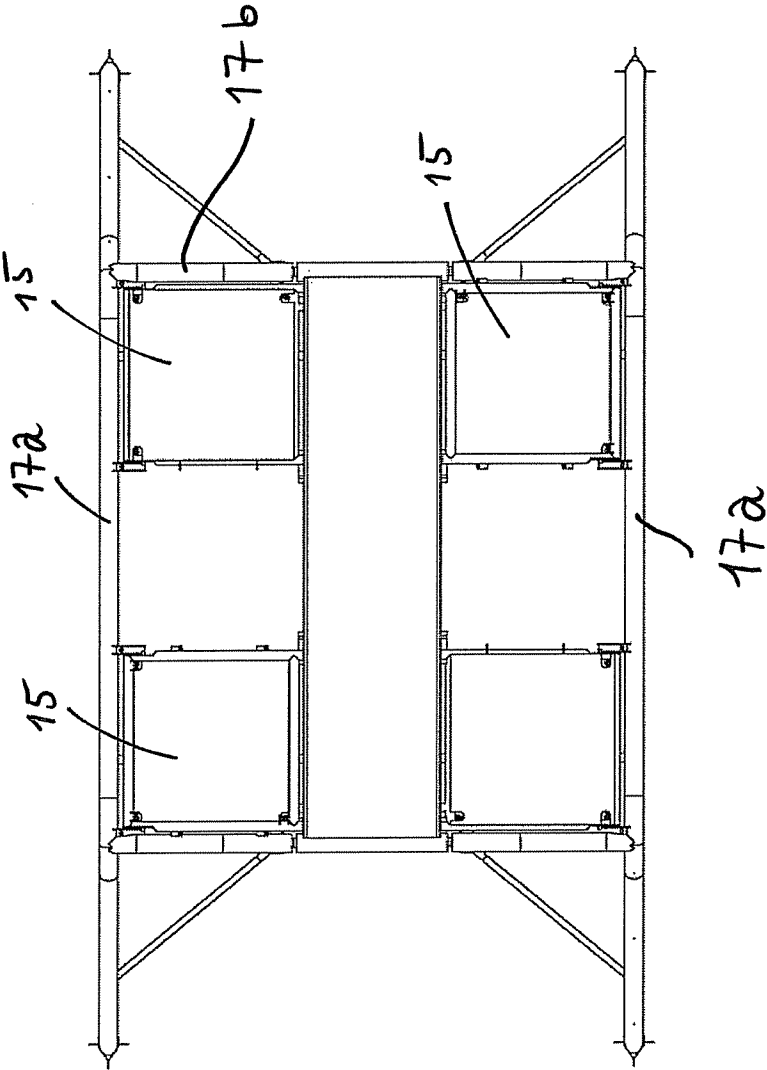


Fig. 8

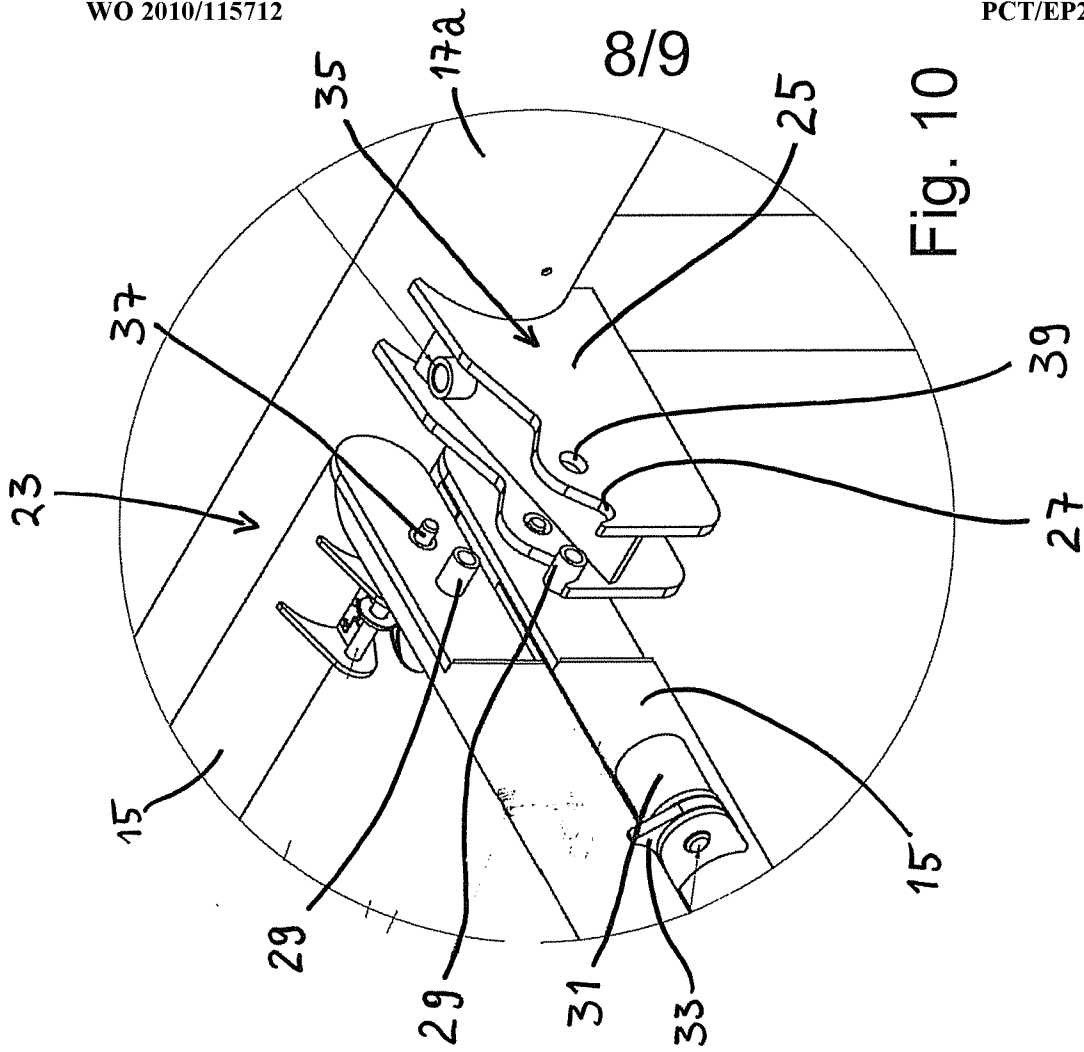
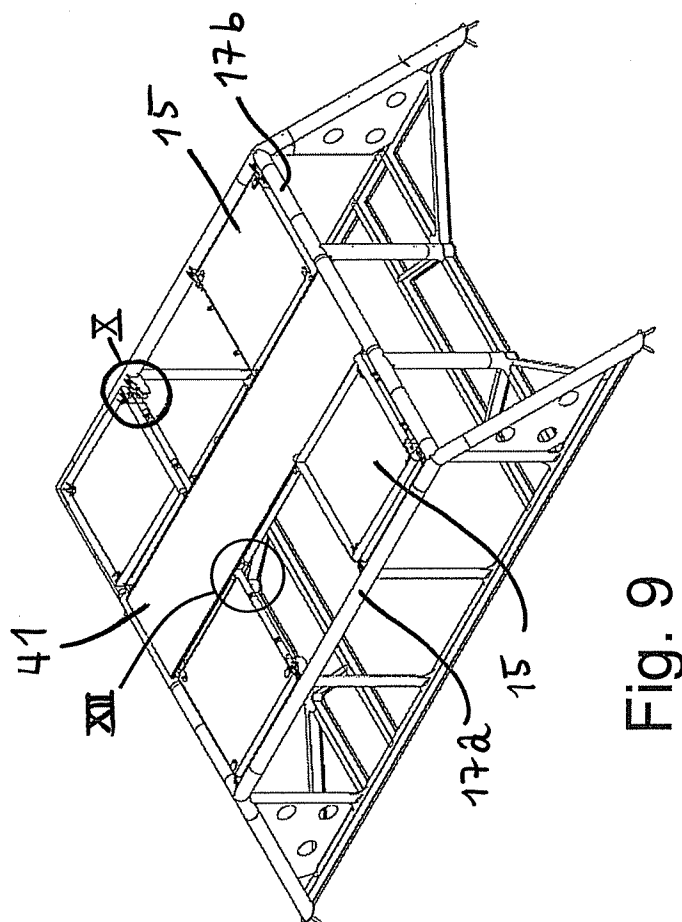


Fig. 10



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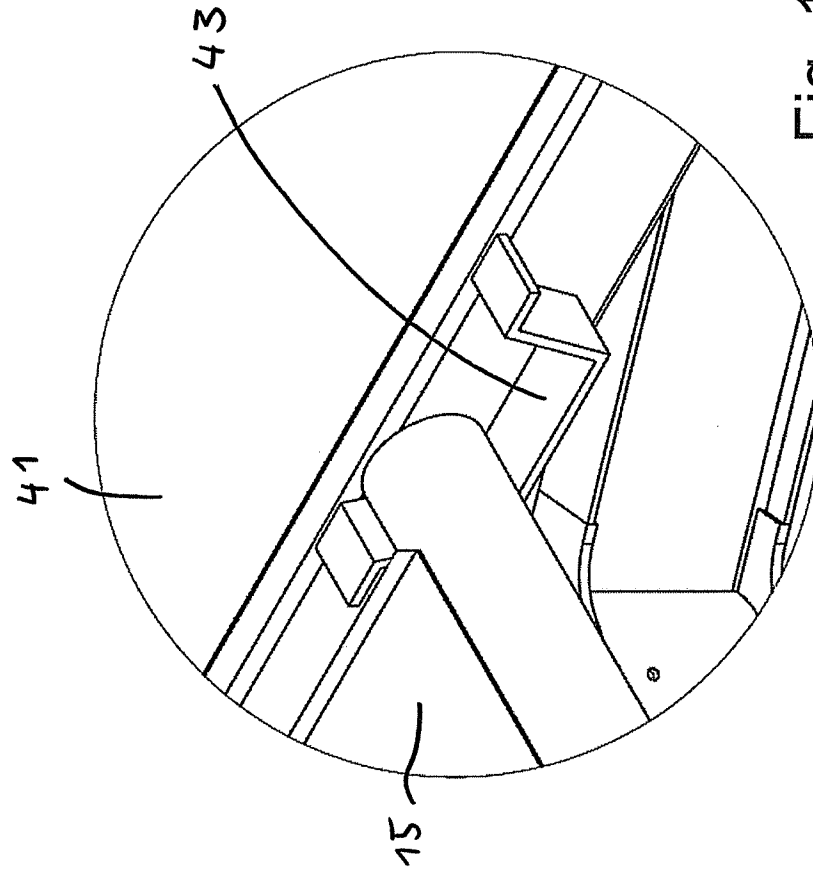


Fig. 12

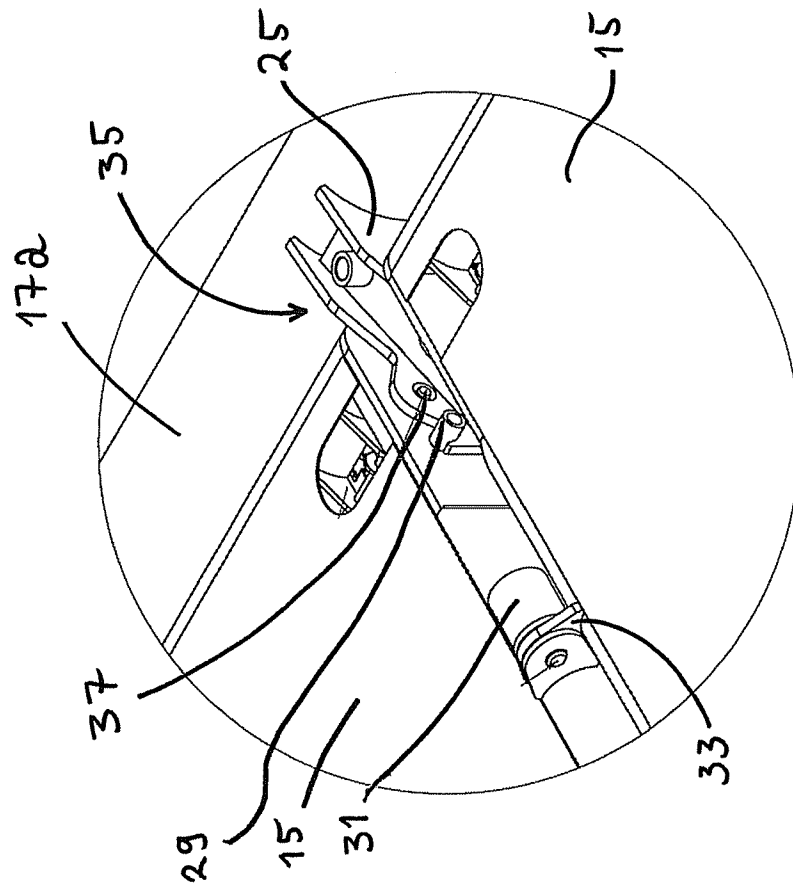


Fig. 11