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(54) **Title:** DEFLECTOR INTENDED TO GUIDE A LINE AND RELATED GUIDING ASSEMBLY

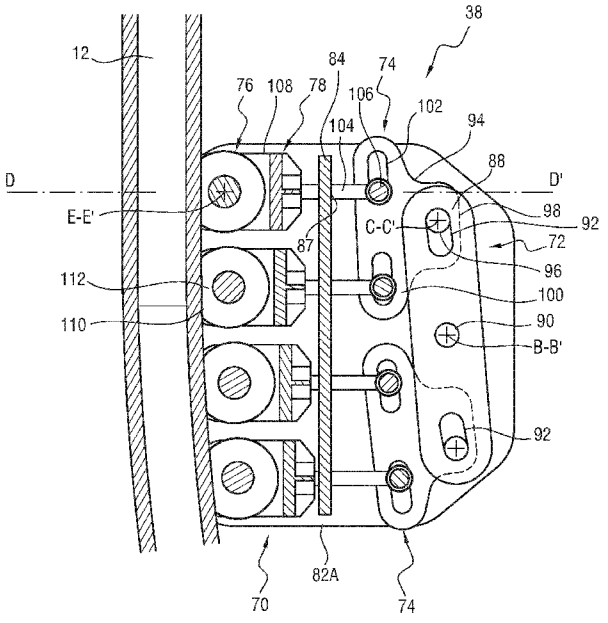


FIG.3

(57) **Abstract:** The deflector (38) comprises: - a support (70); - an intermediate member (72), pivotally mounted in the support (70) around a first rotation axis (B-B'); - at least a secondary pivoting member (74), pivotally connected to the intermediate member (72) around a second rotation axis (C-C') parallel to the first rotation axis (B-B'); - for each secondary pivoting member (74), at least a pair of rotating members (76). Each rotating member (76) is connected to the secondary pivoting member (74). The deflector (38) comprises: - a guiding mechanism, for guiding each rotating member (76) in translation with regard to the support (70) along a translation axis (D-D') non parallel to the first rotation axis (B-B'); - a connecting member (78), pivotally mounted to the secondary pivoting member (74). The rotating member (76) is rotatably mounted on the connecting member (78) around a rotating member rotation axis (E-E').

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Deflector intended to guide a line and related guiding assembly

The present invention concerns a deflector, intended to guide a line, in particular a line introduced in a body of water, comprising:

- a support;
- an intermediate member, pivotally mounted in the support around a first rotation axis;
- at least a secondary pivoting member, pivotally connected to the intermediate member around a second rotation axis parallel to the first rotation axis;
- for each secondary pivoting member, at least a pair of rotating members, each rotating member being connected to the secondary pivoting member.

Such a deflector is intended to be used for guiding a line moving in an installation, notably in an installation for laying or/and recovering a line. The installation is for example a laying vessel or an offshore platform able to lay a line in a body of water from the surface of the body of water. In other applications, the installation is in a shipyard or is located onshore.

The line moved in the installation is advantageously a flexible pipe, in particular an unbonded flexible pipe or a bonded flexible pipe. A flexible pipe is for example a pipe according to the standards API 17J (Specification for Unbonded Flexible Pipe) and API RP 17B (Recommended Practice for Flexible Pipe) established by the American Petroleum Institute. In a variant, the line moved in the installation is a rigid pipe, an umbilical, or a cable.

The laying of a pipe from a vessel generally implies guiding the pipe into the body of water from a laying tower located on the laying vessel. Generally, the pipe is passed on the laying tower, and guided into the water, either through a moon pool located at the center of the vessel (for example in J-lay method) or at the back of the vessel (for example in S-lay method).

The pipe needs to be accurately guided to ensure correct positioning when it enters the body of water, to warrant structural integrity of the pipe and/or to promote forced direction changing of the pipe.

Accordingly, deflectors have been widely used to guide pipes during laying operations. Some deflectors are fixed. Other deflectors comprise rollers or moving tracks.

In some cases, over bending of the pipe may occur at the deflector. In such occurrences, the force distribution applying on the pipe may concentrate on very limited regions of the pipe. This leads to an increase in the stress applied to the pipe, and may damage the pipe in case of excess friction. Such damages may irreversibly affect the pipe operation and shorten its service life.

US 6 719 008 discloses an offshore loading system in which a pipe is suspended between two vessels. A deflector comprising a support, an intermediate member pivotally mounted on the support and a pair of rotating members each connected to a secondary pivoting member are supported on a cable. This assembly adapts to the shape of the cable. It nevertheless lacks robustness to be used as a deflector in a pipe laying installation.

One aim of the invention is to provide a deflector adapted for guiding a line being moved in particular in a body of water, which has a simple structure and which greatly reduces the risk of damaging the line.

To this aim, the subject-matter of the invention is a deflector of the above type, characterized in that the deflector comprises, for each rotating member:

- a guiding mechanism, for guiding each rotating member in translation with regard to the support along a translation axis non parallel to the first rotation axis;

- a connecting member, pivotally mounted with regards to the secondary pivoting member, the rotating member being rotatably mounted on the connecting member around a rotating member rotation axis.

The deflector according to the invention comprises one or more of the following features, taken solely, or according to any technical feasible combination:

- each rotating member is able to move in translation exclusively along the translation axis ;

- the rotation axis of each rotating member is fixed with regards to the support ;

- it comprises at least two secondary pivoting members, mounted on opposite sides of the intermediate member in reference to the first rotation axis, each secondary pivoting member being connected to at least a pair of rotating members;

- it comprises, for each secondary pivoting member, at least two connecting members pivotally mounted on opposite sides of the secondary pivoting member;

- one of the intermediate member and of the support defines a slot, the other one of the intermediate member and of the support comprising a rod inserted in the slot;

- for each connecting member, one of the secondary pivoting member and of the connecting member defines an oblong hole, the other one of the connecting member and of the secondary pivoting member comprising a pivot inserted in the oblong hole;

- the support defines an auxiliary guiding path for guiding the pivot in translation;

- the guiding mechanism comprises, for each rotating member, at least a protrusion connected to one of the rotating member and of the support, the other one of the rotating member and of the support defining a guiding slide receiving the protrusion, the guiding slide extending along the translation axis;

- the support comprises two side plates and a transverse cross member connecting the side plates, the intermediate member, the at least one secondary pivoting member, and the at least one pair of rotating members being received between the two side plates;

- it comprises at least a tertiary pivoting member inserted between the intermediate member and the secondary pivoting member, the tertiary pivoting member being pivotally connected to the intermediate member and to the secondary pivoting member ;

- the guiding mechanism comprises at least an adjustable stop, able to block the translation of the rotating member along the translation axis;

- it comprises at least a sensor able to measure the position of the rotating member along the translation axis;

- each rotating member defines a groove for receiving the line;

- each rotating member comprises peripheral teeth, the deflector comprising an endless member engaged with the teeth of each rotating member.

The invention further concerns a line guiding assembly in an offshore or onshore or subsea installation, the line guiding assembly comprising:

- a central supporting ring, defining a central lumen in which the line is intended to go through;

- two supporting beams, mounted free in rotation on the central ring, the supporting beams laying on an upper supporting surface defined on the central ring, the supporting beams protruding radially beyond the outer circumference of the central ring;

- a deflector as defined above, carried by each supporting beam.

The guiding assembly according to the invention may comprise one or more of the following features, taken solely, or according to any technical feasible combination:

- it comprises two parallel supporting beams, each supporting beam laying on an upper supporting surface of the central ring, and a cross member connecting the two parallel supporting beams, the deflector being mounted between the two parallel supporting beams.

The invention also concerns an offshore or onshore or subsea installation comprising a guiding assembly as defined above.

The invention also relates to a line guiding assembly in an offshore or onshore or subsea installation, the line guiding assembly comprising:

- a central supporting ring, defining a central lumen in which the line is intended to go through;

- a pair of support beams, mounted free in rotation on the central ring, the support beams laying on an upper supporting surface defined on the central ring, the support beams protruding radially beyond the outer circumference of the central ring ;

- a line deflector, carried by each support beam.

The deflector is not necessarily as described above.

The invention will be better understood, upon reading of the following description, given solely as an example, and made in reference to the appended drawings, in which:

- figure 1 is a schematic perspective view of an installation for laying a line comprising a guiding assembly according to the invention;

- figure 2 is a perspective view of a deflector according to the invention, mounted in the guiding assembly of figure 1;

- figure 3 is a median cross-section of the deflector of figure 2;

- figure 4 is a schematic kinetic scheme of the deflector of figure 2;

- figure 5 is a view similar to figure 2, illustrating a second deflector according to the invention;

- figure 6 is a view similar to figure 2 illustrating a third deflector according to the invention;

- figure 7 is a view similar to figure 3 illustrating a fourth deflector according to the invention;

- figure 8 is a view similar to figure 3 illustrating a fifth deflector according to the invention.

An installation 10 according to the invention is shown schematically in figure 1. The installation 10 is here a line laying installation intended for laying a line 12 in a body of water 14.

The line 12 is for example a flexible pipe, in particular an unbonded or a bonded flexible pipe such as disclosed in Standards API 17J (Specification for Unbonded Flexible Pipe) and API RP 17B (Recommended Practice for Flexible Pipe) established by the American Petroleum Institute.

In variant, the line 12 is an umbilical, an integrated production bundle, and/or a cable. In other variants, the line 12 is a rigid pipe made of at least one, preferably several assembled sections of rigid tubing.

The body of water 14 is for example a sea, an ocean, a lake and/or a river. The depth of the body of water 14, taken from the surface to the bottom of the body of water 14 at the laying site is generally comprised between 50 m and 3000 m.

The installation 10 comprises a surface assembly 16, at the surface of the body of water 14, a laying tower (not shown), placed on the surface assembly 16 to drive the line out of the surface assembly 16, and an assembly 18 for guiding the line into the body of water 14.

The surface assembly 16 here comprises a central vertical opening 20 or “moon pool” opening downwardly in the body of water 14. In a variant, the surface assembly 16 comprises a supporting structure on one side of the surface assembly 16 which protrudes above the body of water 14.

The guiding assembly 18 is here located above the central opening 20, or on the supporting structure. It comprises a central supporting ring 30 extending around a central axis A-A’, a pair of supporting beams 32A, 32B mounted free in rotation around the central axis A-A’ on the supporting ring 30 and a cross-member 34 connecting together the supporting beams 32.

The guiding assembly 18 further comprises a cradle 36, carried by the supporting beams 32A, 32B and a deflector 38 according to the invention, mounted in the cradle 36.

The supporting ring 30 delimits a central lumen 40, located above the body of water 14. The supporting ring 30 defines an upper supporting surface 42, an inner circumferential surface 44 and an outer circumferential surface 46.

The supporting ring 30 is fixedly mounted on the surface assembly 16, for example on a deck of the surface assembly 16.

In the example of figure 1, the supporting ring 30 is made in several segments assembled together, for example four segments. In a variant (not shown), the supporting ring 30 is made in one piece.

Each beam 32A, 32B extends transversely to the axis A-A’ above the supporting ring 30. It lays on the upper surface 42 of the supporting ring 30.

Each beam 32A, 32B here has a central linear section 48 and two opposite end sections 50 diverging from the central section 48, away from the other beam 32B, 32A.

At least one end section 50 of each beam 32A, 32B protrudes radially beyond the supporting ring 30, beyond the outer circumferential surface 46.

The central sections 48 of the beams 32A, 32B are substantially parallel to one another. The beams 32A, 32B delimit between them a central passage 52 containing the central axis A-A’ of the ring 30.

Each beam 32A, 32B is equipped with rollers 54, 56, 58 protruding downwardly on the supporting ring 30 from an end section 50.

Each end section 50 is equipped with at least a roller 54 substantially horizontal to roll on the upper supporting surface 42. It is also equipped with an inner substantially vertical roller 56 to roll on the inner circumferential surface 44. Additionally, at least one of the end sections 50 is equipped with an outer substantially vertical roller 58 to roll on the outer circumferential surface 46, the outer roller 58 protruding downwards from the protruding part of the end section 50.

The cross-member 34 rigidly connects the beams 32A, 32B transversely. The beams 32A, 32B and the cross-member 34 are thus jointly movable in rotation around axis A-A', relative to the supporting ring 30. In this example, the cross-member 34 extends between the upper surfaces of each beam 32A, 32B above the central linear section 48, on one side of the central axis A-A'.

The cradle 36 comprises side plates, each connected to a respective beam 32A, 32B.

The assembly comprising the beams 32A, 32B, the cross-member 34, the cradle 36 and the deflector 38 is able to freely rotate around axis A-A' on the supporting ring 30 over an angle which is greater than 360°. It adapts automatically to the configuration of the line 12, especially to its relative orientation in the region between the body of water 14 and the surface assembly 16.

In reference to figures 2 to 4, the deflector 38 comprises a support 70 fixed on the cradle 36, at least an intermediate member 72 pivotably mounted on the support 70 around a first rotation axis B-B' and at least a pair of secondary pivoting members 74, preferably two pairs of secondary pivoting members 74, pivotably connected to the intermediate member 72, each secondary member 74 pivoting along a second rotation axis C-C' parallel to the first rotation axis B-B'.

The deflector 38 further comprises, for each secondary pivoting member 74, a pair of rotating members 76 connected to the secondary pivoting member 74, and for each rotating member 76, a connecting member 78 connecting the rotating member 76 to the secondary pivoting member 74.

According to the invention, the deflector 38 also includes a guiding mechanism 80 (visible in figure 2) for guiding each rotating member 76 and each connecting member 78 in translation with regard to the support 70 along a respective translation axis D-D' non parallel to the first axis B-B'.

As shown in figure 2, the support 70 comprises two parallel side plates 82A, 82B, orthogonal to the first rotation axis B-B'. It also includes at least a transverse cross-member 84 connecting the side plates 82A, 82B together.

In the orientation of figure 2, the plates 82A, 82B extend substantially vertically. They define an intermediate space 86 in which the intermediate member 72, the secondary pivoting member 74, the rotating members 76 and the connecting members 78 are positioned.

The transverse cross-member 84 connects the two side plates 82A, 82B through the intermediate space 86. The intermediate cross-member defines a plurality of trough holes 87, through which the connecting members 78 are engaged.

The intermediate member 72 is formed of a pivoting bar 88 pivotably mounted on the support 70 through an axle 90 connected to the side plates 82A, 82B.

The pivoting bar 88 defines, for each pair of secondary pivoting members 74, a slot 92 located on one side of the first rotation axis B-B'. In the example of figure 2, in which the deflector 38 comprises two pairs of secondary pivoting member 74, the pivoting bar 88 defines two opposite slots 92 located on opposite sides of the first rotation axis B-B'.

Each slot 92 extends longitudinally along the pivoting bar 88.

In the example of figure 2, each pair of secondary pivoting member 74 comprises a secondary pivoting member 74 on each lateral side of the intermediate member 72, inserted between the intermediate member 72 and a respective side plate 82A, 82B, facing a slot 92. The secondary pivoting members 74 of each pair of secondary pivoting members 74 are each connected to the same pair of rotating members 76.

As shown in figure 3, each secondary pivoting member 74 comprises a plate 94 and a rod 96 mounted in the plate 94 to hinge the plate 94 to the intermediate member 72.

The plate 94 has a substantially T-shape, with a narrower region 98 locating facing the intermediate member 72 and a wider region 100 protruding from the intermediate member 72 towards the rotating members 76.

The rod 96 protrudes laterally from the narrower region 98, parallel to the first rotation axis B-B'. It is received in the slot 92 of the intermediate member 72.

The wider regions 100 define, for each rotating member 76, an oblong hole 102 receiving the connecting member 78.

Each connecting member 78 comprises a bar 104, a pivot 106 inserted in the oblong hole 102 and a half-clevis 108 receiving the rotating member 76.

The pivot 106 protrudes laterally at one end of the bar 104. The half-clevis 108 protrudes longitudinally at another end of the bar 104.

Each rotating member 76 defines a surface 110 for contacting the line 12. The surface 110 here delimits a central groove 112 for receiving the line 12.

Each rotating member 76 is rotatably mounted on the connecting member 78, at the half-clevis 108, around a rotating member rotation axis E-E', parallel to the first rotation axis B-B' and to the second rotation axis C-C'.

As shown in figure 2, the guiding mechanism 80 comprises at least a protrusion 120 jointly movable with each rotating member 76, and for each protrusion 120, a guiding slide 122 defined in the support 70.

The guiding mechanism 80 further comprises at least a secondary guiding path 124 for guiding in translation the rod 96 of each secondary pivoting member 74 and an

additional guiding path 126 for guiding the pivot 106 of each connecting member 78 in translation along an axis parallel to the translation axis D-D'.

In the example of figure 2, the guiding mechanism 80 comprises, for each rotating member 76, two opposite protrusions 120 jointly movable in translation with the rotating member 76. The opposite protrusions 120 are located on opposite sides of the rotating member 76, here on the outer surfaces of each half-clevis 108.

Each guiding slide 122 is formed in a respective side plate 82A, 82B of the support 70. The guiding slide 122 is here a notch emerging longitudinally out of the side plate 82A, 82B.

The notch has a shape partially complementary to the shape of the protrusion 120, to limit the movement of the protrusion 120 along the translation axis D-D'. The translation axis D-D' is perpendicular to the rotating member rotation axis E-E'. By cooperation of the protrusion 120 in the guiding slide 122, each rotating member 76 is able to move in translation exclusively along the translation axis D-D'.

The secondary guiding path 124 comprises, for each secondary pivoting member 74, an oblong through-hole made in a side plate 82A, 82B of the support 70. The oblong through-hole extends along an axis parallel to the translation axis D-D'.

The additional guiding path 126 is also made of an oblong through-hole vertically and horizontally shifted with regards to each secondary guiding path 124. It receives the pivot 106 of a connecting member 78.

The oblong through-hole extends along the translation axis D-D' of the rotating member 76 to which the connecting member 78 is connected.

The connecting member 78 is thus able to move in translation with regard to the support 70, only along the translation axis D-D'.

The operation of the guiding assembly 18 according to the invention, during the moving of a line 12 in a body of water 14 will be now described.

Initially, as shown in figure 1, the line 12 is vertically introduced into the central passage 52 defined between the beams 32A, 32B. It is lowered to the body of water 14.

The deflector 38 is in a rest initial configuration shown in dotted lines in figure 4. In this configuration, the intermediate member 72 is substantially vertical. The pairs of secondary pivoting members 74 are vertically aligned on top of one another. The rotating members 76 are also aligned vertically.

When the line 12 bends, as shown in figure 4, its outer surface applies on the deflector 38. More precisely, the outer surface of the line 12 contacts the rotating members 76 in the grooves 112 defined in each rotating member 76.

Each of the rotating members 76 translate along their translation axis D-D' to adapt to the local shape of the line 12. The translation movement of each rotating member 76 is transmitted to the secondary pivoting members 74 through the connecting members 78, which translate accordingly. The movement of the rotating members 76 and of the connecting members 78 is guided by the translation of the protrusions 120 in the guiding slides 122 and by the translation of the pivots 106 in the additional guiding paths 126 and in the oblong holes 102.

Depending on the relative position of each secondary pivoting member 74, the intermediate member 72 pivots around the first rotation axis B-B'.

In the example of figures 3 and 4, the secondary pivoting members 74 in the upper region of the support 70 shift out of the support 70 towards the central axis A-A' of the guiding assembly 18, whereas the secondary pivoting members 74 in the lower region of the support 70 shift in the support 70, away from the central axis A-A'.

The deflector 38 thus auto-adapts to the shape of the line 12, without external intervention or control.

Additionally, if a torsion force occurs on the line 12, the assembly of the beams 32A, 32B, cross-member 34 and deflector 38 pivots around the central axis A-A' to adapt to the shape of the line 12.

As a consequence, the forces applying on the line 12 by each rotating member 76 balance and are equal in module and direction, as shown in figure 4.

This effect is obtained whichever rotating member 76 touches the line 12 first, due to the transmission of force by translation of the rotating members 76 and of the connecting members 78 and by respective pivotal of the secondary pivoting members 74 and of the intermediate member 72 around their respective rotation axis C-C' and B-B'.

Equal force distribution along the entire contact path between the line 12 and the deflector 38 thus occurs, which leads to better load distribution on the line 12 and consequent mitigation of stress concentrations, whatever the radius of curvature of the line 12 in the contact region at each instant. This greatly improves the fatigue properties in dynamic applications.

The deflector 38 is therefore very flexible. As a consequence, product integrity is guaranteed and operational costs are reduced.

The deflector 38 of a variant of guiding assembly 18 according to the invention is shown in figure 5. The deflector 38 shown in figure 5 differs from the deflector 38 shown in figures 2 and 3 in that it further comprises sensors 130 for sensing the displacement of each rotating member 76 in translation with regard to the support 70.

The sensor 130 is for example a Linear Variable Differential Transformer (LVDT), which produces an electrical signal representative of the displacement.

In the example of figure 5, each sensor 130 is jointly movable with the rotating member 76. It is for example connected to the connecting member 78, advantageously at the pivot 106.

Each sensor 130 is also connected to a calculation unit (not shown) which is able to determine the position of each rotating member 76 in the support 70 at each instant. From these positions, the calculation unit deduces and monitors the local bending radius of the line 12 in the deflector 38.

In a variation shown in figure 6, the deflector 38 includes adjustable stops 132 able to limit the translation of each rotating member 76 away from the axis A-A'.

Each adjustable stop 132 is for example made of an adjustable screw, protruding in each additional guiding path 126, to limit the travel of the connecting member 78 along its translation axis D-D'. The length of the protruding part of the screw into the additional guiding path 126 is adjustable to adjust the maximum travel of the connecting member 78.

The use of adjustable stops 132 allows a control of the minimum bending radius which can apply on the line 12.

The deflector 38 of figure 7 differs from the deflector 38 of figures 2 and 3 by the use of an additional rotating member 76. Tertiary pivoting members 134 pivotably connect the intermediate member 72 with each secondary pivoting members 74. The tertiary pivoting members 134 have a shape similar to the shape of the secondary pivoting members 74. They are each hinged on one side to the intermediate member 72 and on the other side to a secondary pivoting member 74.

The number of rotating members 76 can be increased by introducing more intermediate pivoting members 74, 134.

The deflector 38 of figure 8 differs from the deflector 38 of figures 2 and 3 in that the rotating members 76 do not directly contact the line 12. Each rotating member 76 has peripheral teeth 140 around the outer circumference of the rotating member 76. The deflector 38 further comprises an endless member 142 meshing with the teeth 140 of the rotating members 76 and with fixed tooth wheels 144 surrounding the support 70.

The endless member 142 here comprises a chain. The endless member 142 preferentially carries pads 146 defining grooves for guiding the line 12.

The operation of the deflector 38 of figure 8 only differs from the operation of the deflector 38 shown in figure 2 by the contact of the line 12 with the pads 146 on the endless member 142, which transmit their movement to the rotating members 76.

The deflector 38 has been described above in an offshore line laying installation 10. In a variant, it is used offshore in a line recovery installation, a drilling installation, an offshore platform. In another variant, it is used onshore.

In a variant (not shown), the support 70 defines a slot 92, the intermediate member 72 comprising a rod 96 inserted in the slot 92.

In another variant (not shown), the connecting member 78 defines an oblong hole 102, the secondary pivoting member 74 comprising a pivot 106 inserted in the oblong hole 102.

In another variant (not shown), a protrusion 120 is connected to the support 70, the rotating member 76 defining a guiding slide 122 receiving the protrusion 120.

As shown in particular in figures 2 to 4, the rotation axis D-D' of each rotating member 76 is fixed with regards to the support 70.

CLAIMS

1.- Deflector (38) intended to guide a line (12), comprising:

- a support (70) ;

- an intermediate member (72), pivotally mounted in the support (70) around a first rotation axis (B-B');

- at least a secondary pivoting member (74), pivotally connected to the intermediate member (72) around a second rotation axis (C-C') parallel to the first rotation axis (B-B');

- for each secondary pivoting member (74), at least a pair of rotating members (76), each rotating member (76) being connected to the secondary pivoting member (74);

characterized in that the deflector (38) comprises, for each rotating member (76) :

- a guiding mechanism (80), for guiding each rotating member (76) in translation with regard to the support (70) along a translation axis (D-D') non parallel to the first rotation axis (B-B');

- a connecting member (78), pivotally mounted with regards to the secondary pivoting member (74), the rotating member (76) being rotatably mounted on the connecting member (78) around a rotating member rotation axis (E-E').

2.- Deflector (38) according to claim 1, comprising at least two secondary pivoting members (74), mounted on opposite sides of the intermediate member (72) in reference to the first rotation axis (A-A'), each secondary pivoting member (74) being connected to at least a pair of rotating members (76).

3.- Deflector (38) according to any one of the preceding claims, comprising, for each secondary pivoting member (74), at least two connecting members (78) pivotally mounted on opposite sides of the secondary pivoting member (74).

4.- Deflector (38) according to any one of the preceding claims, wherein one of the intermediate member (72) and of the support (70) defines a slot (92), the other one of the intermediate member (72) and of the support (70) comprising a rod (96) inserted in the slot (92).

5.- Deflector (38) according to any one of the preceding claims, wherein, for each connecting member (78), one of the secondary pivoting member (74) and of the connecting member (78) defines an oblong hole (102), the other one of the connecting

member (78) and of the secondary pivoting member (74) comprising a pivot (106) inserted in the oblong hole (102).

6.- Deflector (38) according to claim 5, wherein the support (70) defines an auxiliary guiding path (126) for guiding the pivot (106) in translation.

7.- Deflector (38) according to any one of the preceding claims, wherein the guiding mechanism (80) comprises, for each rotating member (76), at least a protrusion (120) connected to one of the rotating member (76) and of the support (70), the other one of the rotating member (76) and of the support (70) defining a guiding slide (122) receiving the protrusion (120), the guiding slide (122) extending along the translation axis (D-D').

8.- Deflector (38) according to any one of the preceding claims, wherein the support (70) comprises two side plates (82A, 82B) and a transverse cross member (84) connecting the side plates (82A, 82B), the intermediate member (72), the at least one secondary pivoting member (74), and the at least one pair of rotating members (76) being received between the two side plates (82A, 82B).

9. - Deflector (38) according to any one of the preceding claims, comprising at least a tertiary pivoting member (134) inserted between the intermediate member (72) and the secondary pivoting member (74), the tertiary pivoting member (134) being pivotally connected to the intermediate member (72) and to the secondary pivoting member (74).

10.- Deflector (38) according to any one of the preceding claims, wherein the guiding mechanism (80) comprises at least an adjustable stop (132), able to block the translation of the rotating member (76) along the translation axis (D-D').

11.- Deflector (38) according to any one of the preceding claims, comprising at least a sensor (130) able to measure the position of the rotating member (76) along the translation axis (D-D').

12.- Deflector (38) according to any one of the preceding claims, wherein each rotating member (76) defines a groove (112) for receiving the line (12).

13.- Deflector (38) according to any one of claims 1 to 11, wherein each rotating member (76) comprises peripheral teeth (140), the deflector (38) comprising an endless member (142) engaged with the teeth (140) of each rotating member (76).

14.- Line guiding assembly (18) in an offshore or onshore or subsea installation (10), the line guiding assembly (18) comprising:

- a central supporting ring (30), defining a central lumen (40) in which the line (12) is intended to go through;

- two supporting beams (32A, 32B) , mounted free in rotation on the central ring (30), the supporting beams (32A, 32B) laying on an upper supporting surface (42) defined on the central ring (30), the supporting beams (32A, 32B) protruding radially beyond the outer circumference of the central ring (30) ;

- a deflector (38) according to any one of the preceding claims, carried by each supporting beam (32A, 32B).

15.- Line guiding assembly (18) according to claim 14, comprising two parallel supporting beams (32A, 32B), each supporting beam (32A, 32B) laying on an upper supporting surface (42) of the central ring (30), and a cross member (34) connecting the two parallel supporting beams (32A, 32B), the deflector (38) being mounted between the two parallel supporting beams (32A, 32B).

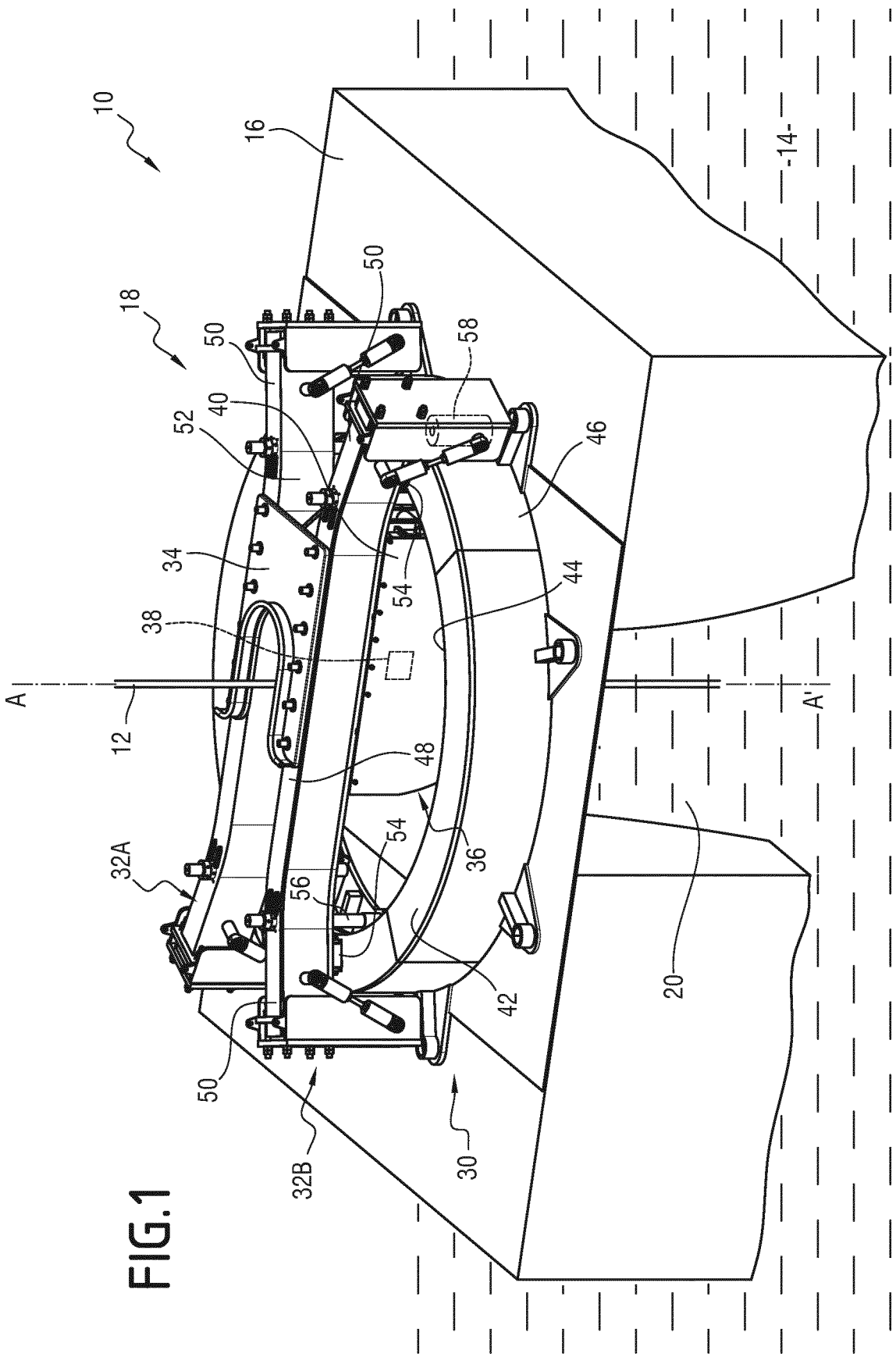

10
16
-14-
18
50
58
40
52
46
34
54
44
38
A
A'
12
48
54
36
32A
56
42
20
50
32B
30

FIG.1

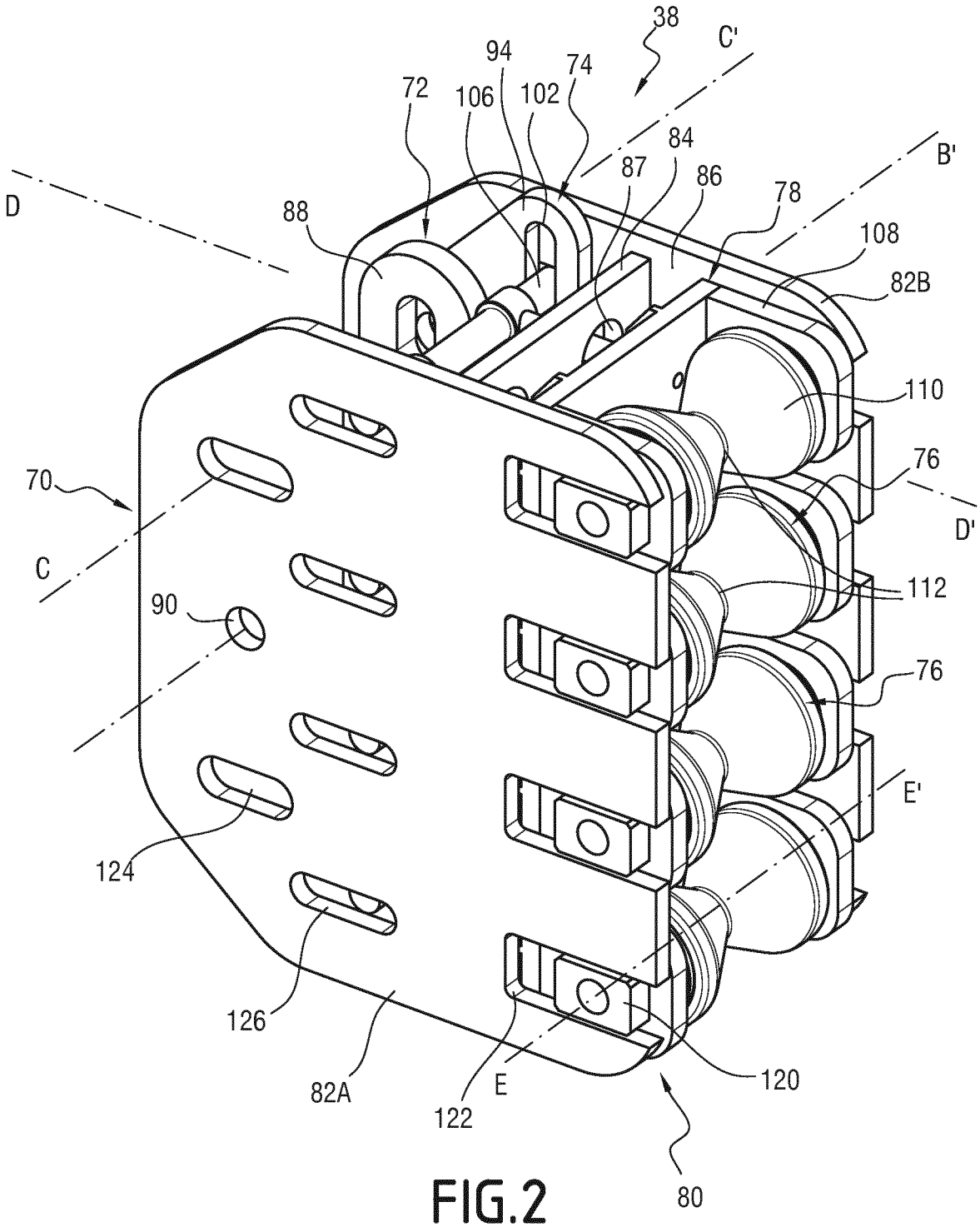

38
C'
94
74
72
106
102
84
87
86
78
B'
D
88
108
82B
110
70
76
D'
C
112
90
76
E'
124
126
82A
E
122
120
80

FIG.2

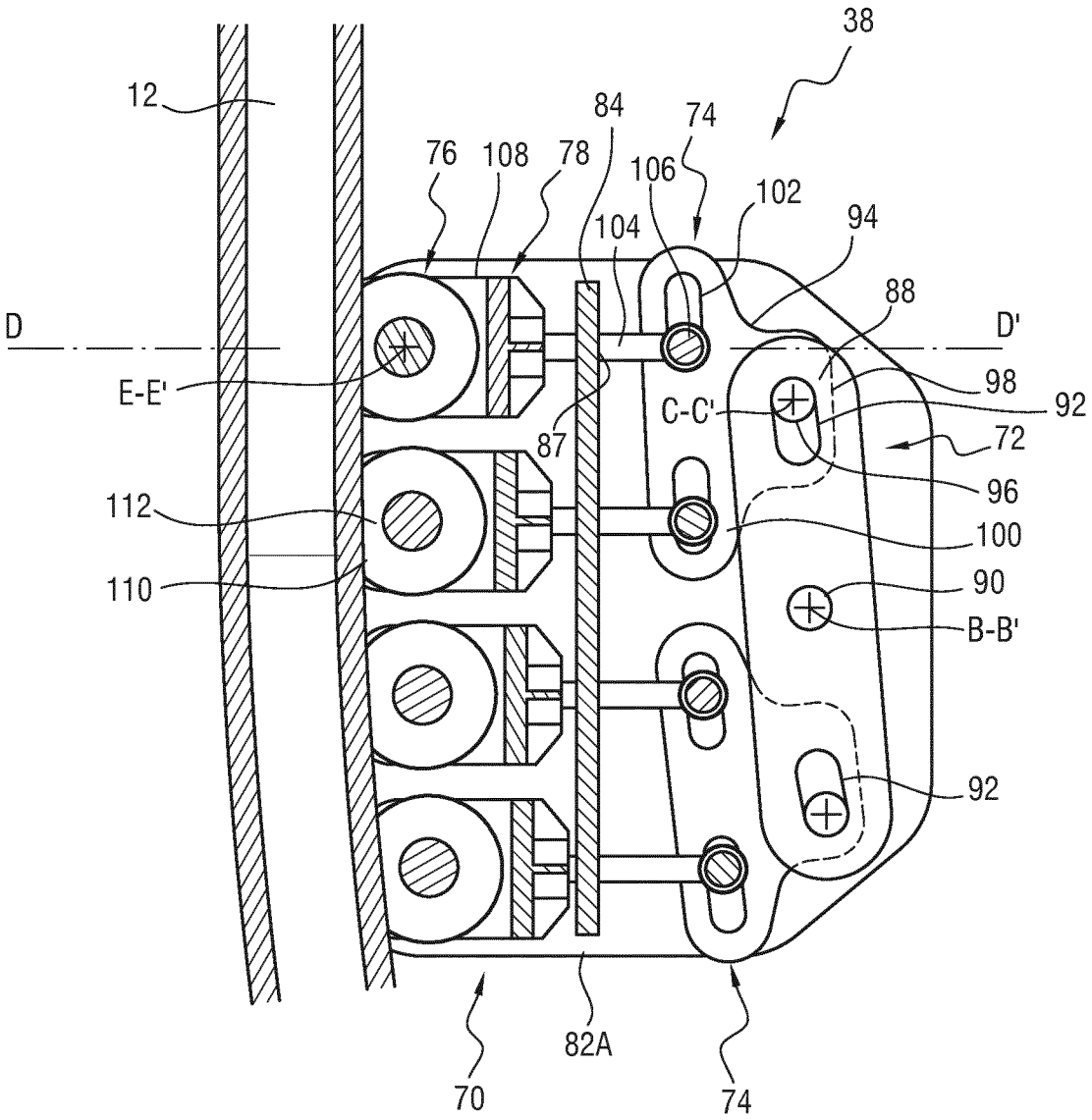

38
12
84
74
76
108
78
106
102
104
94
88
D
D'
E-E'
C-C'
98
92
87
72
96
112
100
110
90
B-B'
92
82A
70
74

FIG.3

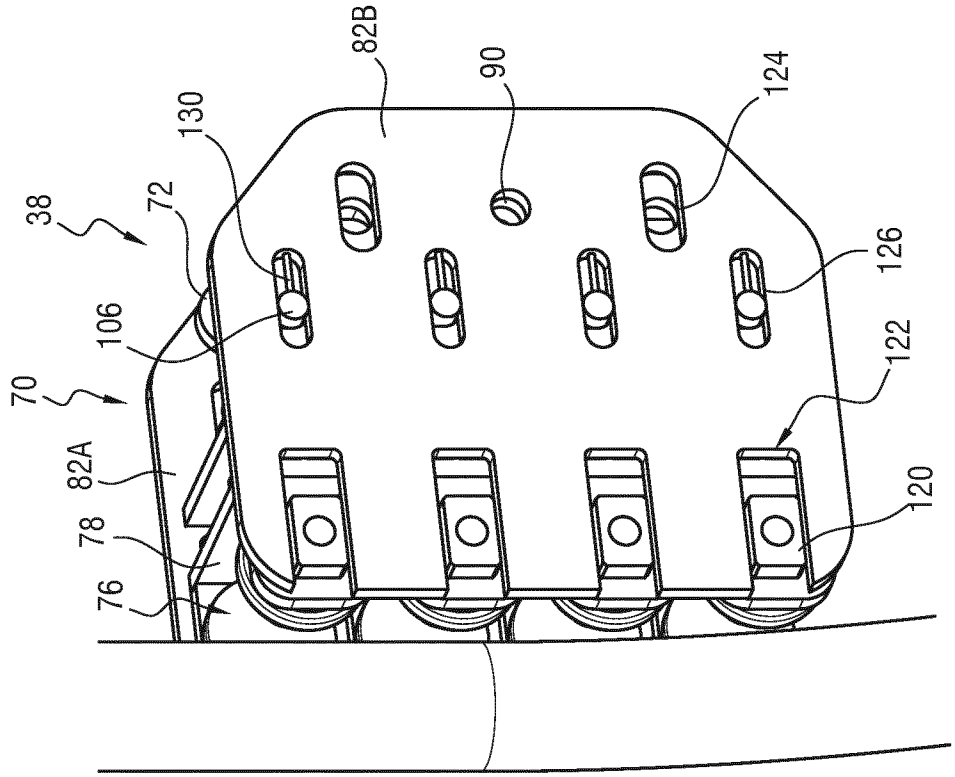

82B
90
124
130
38
72
126
106
122
70
82A
120
78
76

FIG.5

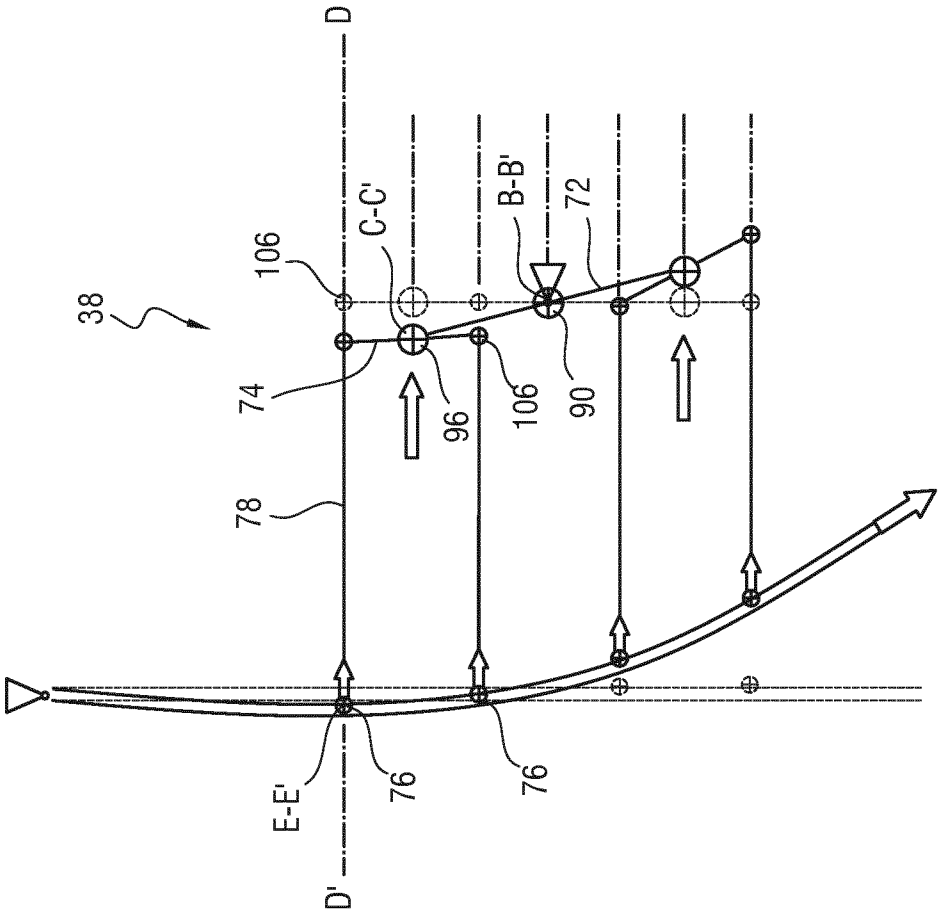

D
C-C'
B-B'
72
106
38
74
96
106
90
78
E-E'
76
76
D'

FIG.4

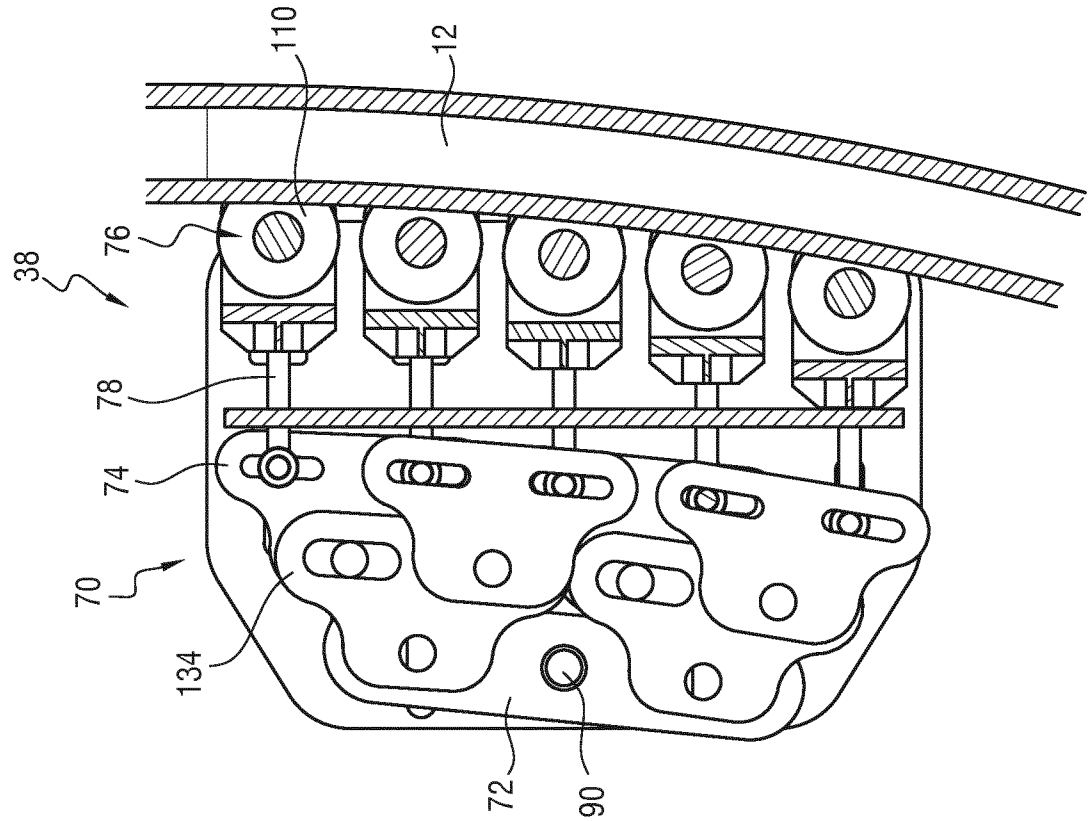

110
12
38
76
78
74
70
134
72
90

FIG.7

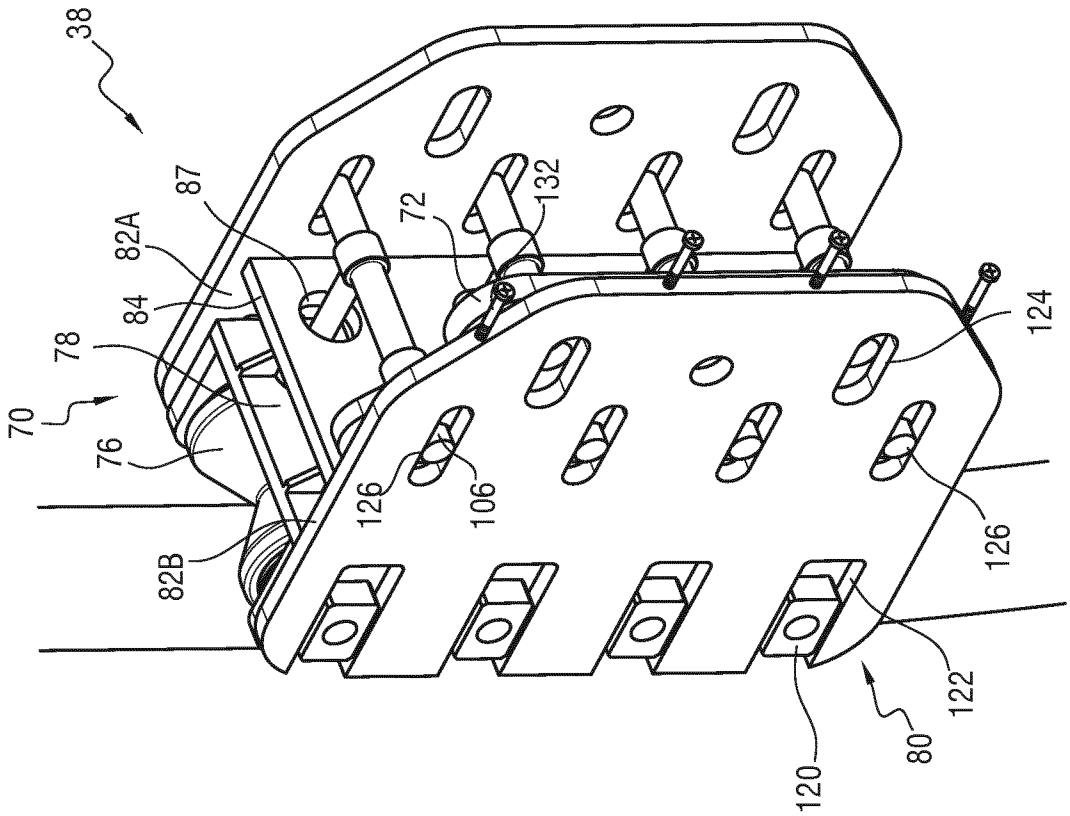

38
87
82A
84
78
70
76
82B
72
132
126
106
124
126
122
120
80

FIG.6

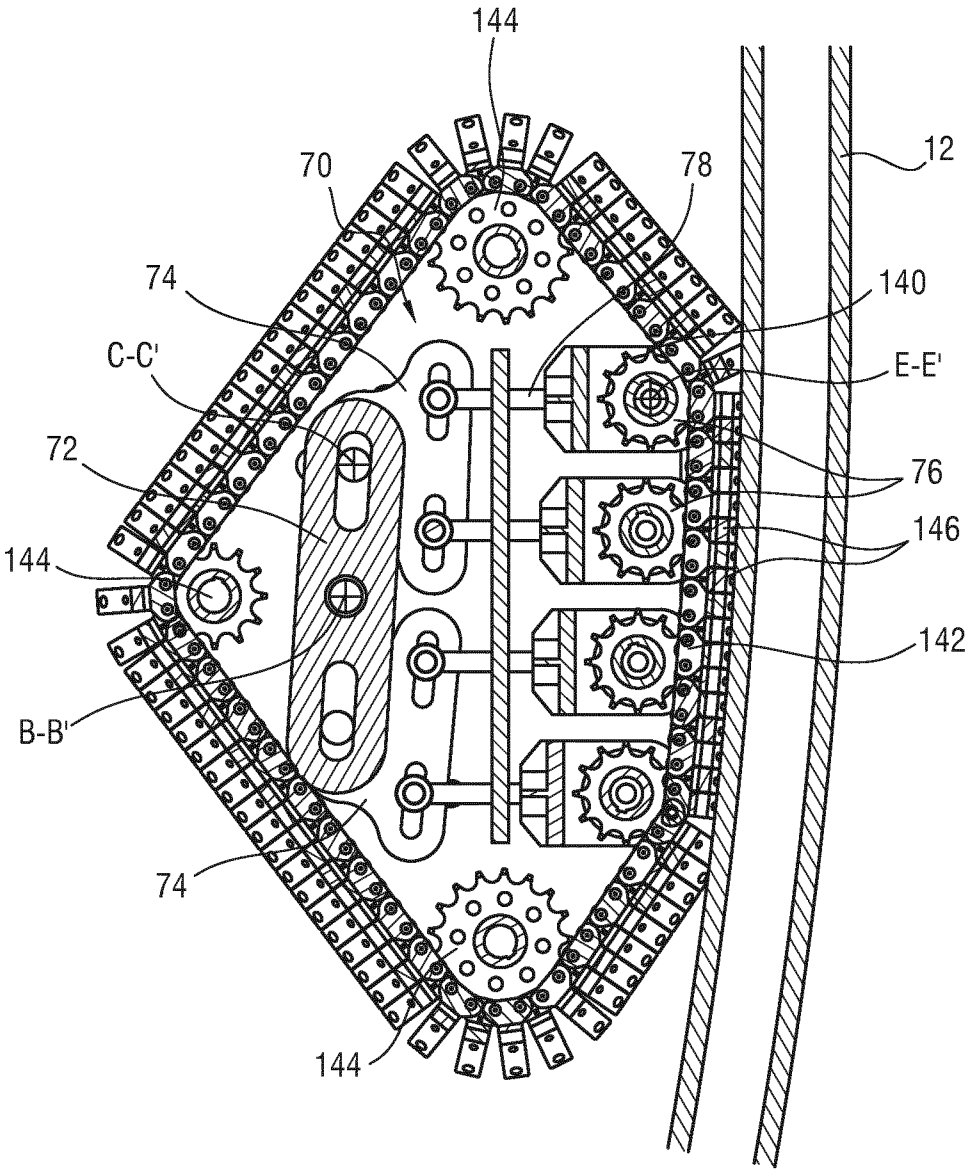


FIG.8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/072611

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16L1/235 H02G1/10 H02G9/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16L H02G B63B B63H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	page 5, line 26 - line 32 page 10, line 1 - page 13, line 22 figures 1a-5	5-7

Y	EP 0 717 222 A1 (STOLT COMEX SEAWAY AS [NO]) 19 June 1996 (1996-06-19)	14,15
A	column 2, line 15 - line 21 figures	1

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 November 2017	20/11/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Vecchio, Giovanni

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/072611

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	page 5, line 18 - page 8, line 28 figures 2-6	5-7,9, 12-15

X	WO 2009/098586 A2 (SAIPEM SPA [IT]; BRUSCHI ROBERTO [IT]; SIGNAROLDI TERESIO [IT]) 13 August 2009 (2009-08-13)	1,2,8, 10-12
A	page 12, line 19 - page 18, line 10 figures 2-10	14,15

1

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Information on patent family members

International application No
PCT/EP2017/072611

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