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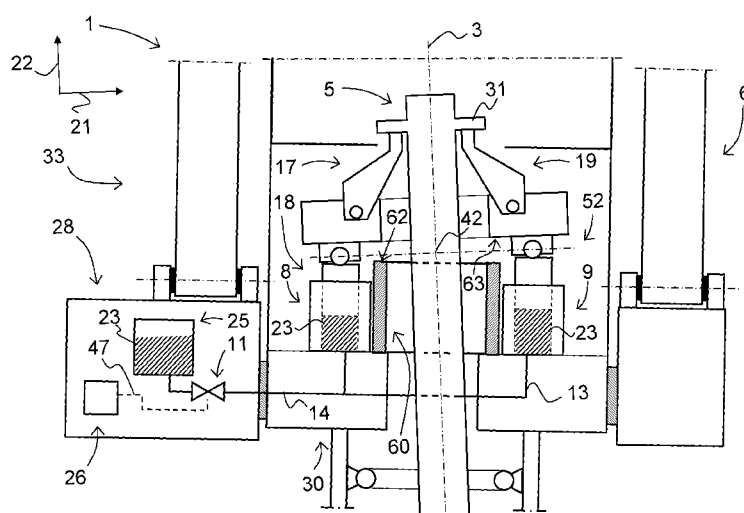


Figure 7

(57) Abstract: A pipeline laying vessel for laying a pipeline (5) on a seabed, which pipeline laying vessel comprises a hull, a positioning device (6) for positioning a pipe section in a firing line (3) along which the pipeline is laid, which positioning device is supported by the hull, and a clamp (17) for holding the pipeline suspended from the vessel, wherein the clamp is located in the firing line, and comprises a support device (18) constructed and arranged to allow the clamp to hold the pipeline in a first mode wherein the clamp has a fixed position relative to the positioning device, and in a second mode (52) wherein the clamp is pivotable relative to the positioning device.

Title: Pipeline laying vessel for laying a pipeline on a seabed

The invention relates to a pipeline laying vessel for laying a pipeline on a seabed, which pipeline laying vessel comprises a hull, a positioning device for positioning a pipe section in a firing line along which the pipeline is laid, which positioning device is supported by the hull, and a clamp for holding the pipeline suspended from the vessel. The clamp is
5 located in the firing line.

The pipeline is laid by positioning a first pipe section in the firing line while using the positioning device. The positioning device may comprise a J-lay tower extending upwardly from the hull in combination with a loader for moving a pipe section into the tower. The positioning device may comprise a substantially horizontal extending S-lay structure.

10 The first pipe section located in the firing line is lowered to the seabed and subsequently held by the clamp. A second pipe section is positioned in the firing line and connected to the first pipe section. For making the connection it is required that the second pipe section held by the positioning device and the first pipe section held by the clamp are positioned in line with each other.

15 The interconnected first and second pipe section are lowered to the seabed and the second pipe section is subsequently held by the clamp. The interconnected first and second pipe section form the pipeline suspended from the vessel. By connecting more pipe sections to the pipeline in the same manner, the pipe line is being laid. Also other type of elements, like inline structures etc, may be added to the pipeline.

20 This means that the pipeline laying operations for laying a pipeline include the above mentioned positioning of a pipe section (or an other type of element) in the firing line, and the connection of the pipe section (or the other type of element) to the pipeline, including all the required operations as for example welding, coating, making up of connectors, attachment of anodes, VIV strakes, and the like.

25 In use, the pipeline laying vessel is located at sea. Depending on the waves, winds and currents, the vessel floating on the sea water is subjected to specific movements. The vessel may swing about the length axis of the vessel, which is called a roll movement about the roll axis. The vessel may swing about the transverse axis of the vessel, which is called a pitch movement about the pitch axis. The vessel may swing about the height axis of the
30 vessel, which is called a yaw movement about the yaw axis.

These movements of the vessel have a negative effect on the condition of the pipeline suspended from the vessel and held by the clamp, especially when the pipeline is subjected to said movements for a long period of time.

When there is bad weather causing the vessel to move too much to perform pipeline
5 laying operations, the pipeline preferably remains suspended from the vessel and held by the clamp. In said situation there is an even larger negative effect on the condition of the pipeline, because the vessel moves more than under normal weather conditions.

The weather conditions may be that bad, that it is required that the clamp is decoupled from the pipeline and abandoned to the seabed. The pipeline will than stay laying
10 on the seabed until the weather conditions improve. When the weather conditions allows it, the pipeline will be recovered from the seabed and placed in the clamp again to resume the pipeline laying operations. Such an abandonment and recovery operation is very time consuming and results in a loss of production time.

The abandonment operation needs to be initiated before the adverse weather arrives. It
15 therefore happens that a pipeline is abandoned and at a later time it becomes clear the weather conditions are less bad than predicted, and that the abandonment operation was not needed. This causes unnecessary loss of production time.

The object of the invention is to provide an improved or at least an alternative pipeline laying vessel for laying a pipeline on a seabed.

20 The object is achieved by a pipeline laying vessel for laying a pipeline on a seabed, which pipeline laying vessel comprises a hull, a positioning device for positioning a pipe section in a firing line along which the pipeline is laid, which positioning device is supported by the hull, and a clamp for holding the pipeline suspended from the vessel, wherein the clamp is located in the firing line, and comprises a support device constructed and arranged
25 to allow the clamp to hold the pipeline in a first mode wherein the clamp has a fixed position relative to the positioning device, and in a second mode wherein the clamp is pivotable relative to the positioning device.

For connecting a pipe section to the pipeline, it is required that the pipe section and the pipeline are aligned. In the vessel according the invention, the support device is placed in
30 the first mode when pipeline laying operations are performed. In the first mode, the clamp has a fixed position relative to the positioning device. This allows an accurate alignment of the pipe section and the pipeline.

Movements of the vessel are transferred to the positioning device supported by the hull. In the first mode said movements are transferred to the pipeline because the clamp has
35 a fixed position relative to the positioning device. Said movements have a negative effect on the condition of the pipeline suspended from the vessel.

During the periods that no pipeline laying operations are or can be performed and the pipeline is held by the clamp, the support device is placed in the second mode. In the second mode, the clamp is pivotable relative to the positioning device. Due to this, movements of the vessel are not or at least in reduced form transferred to the pipeline held by the clamp. This means that in the second mode the negative effect of the movements of the vessel is eliminated or at least reduced. As a result of this, the pipeline suspended from the vessel according to the invention is not or at least in a reduced form subjected to the negative effects of the movements of the vessel when no pipeline laying operations are performed.

Therefore, with the pipeline laying vessel according the invention it will be less often required that the weather conditions are that bad that the pipeline needs to be abandoned. This results in a reduced loss of production time due to bad weather conditions.

Due to the fact that in the second mode the clamp is pivotable relative to the positioning device, a small number of parts is moving relative to the rest of the vessel for compensating the movements of the vessel. If for instance the combination of the clamp and the positioning system together were pivotable relative to the rest of the vessel, there would be a far larger number of moving parts. A larger number of moving parts makes a system more complex. In addition, a system with a larger number of moving parts is subjected to an increased wear. The pipeline laying system according the invention has a simple construction.

Furthermore, due to the fact that in the second mode the clamp is pivotable relative to the positioning device, a relatively small mass has to move relative to the rest of the vessel for compensating the movements of the vessel. If for instance the combination of the clamp and the positioning system together were pivotable relative to the rest of the vessel, a far larger mass would have to move. Due to the inertia of mass, the pipeline is subjected to smaller stresses and strains when a smaller mass has to move for compensating the movements of the vessel than in the situations that a larger mass has to move. Therefore, in the pipeline laying vessel according the invention the stresses and strains to which the pipeline held by the clamp are subjected are minimized.

In an embodiment according the invention, the pipeline laying vessel comprises the features according to any of the enclosed claims.

The invention further relates to a pipeline laying system for laying a pipeline along a firing line and from a pipeline laying vessel comprising a hull, which pipeline laying system comprises;

- a positioning device for in use positioning a pipe section in a firing line along which the pipeline is laid, which positioning device is constructed and arranged to in use be supported by the hull, and

- a clamp for in use holding the pipeline suspended from the vessel, wherein the clamp is located in the firing line, and comprises a support device constructed and arranged to allow the clamp to hold the pipeline in a first mode wherein the clamp has a fixed position relative to the positioning device, and in a second mode wherein the clamp is pivotable relative to the positioning device.

In an embodiment according to the invention, the pipeline laying system comprises the features according to any of the enclosed claims.

The invention further relates to a pipeline laying vessel for laying a pipeline on a seabed, which pipeline laying vessel comprises;

- a hull,
- a pipeline laying system for laying the pipeline along a firing line, which pipeline laying system is supported by the hull, and wherein the pipeline laying system comprises a clamp for holding the pipeline suspended from the vessel, the clamp is located in the firing line, and comprises a support device constructed and arranged to allow the clamp to hold the pipeline in a first mode wherein the clamp has a fixed position relative to the hull and the rest of the pipeline laying system, and in a second mode wherein the clamp is pivotable relative to the hull and the rest of the pipeline laying system.

The invention further relates to a pipeline laying system for laying a pipeline along a firing line and from a pipeline laying vessel comprising a hull, wherein

- the pipeline laying system is constructed and arranged to in use be supported by the hull and comprises a clamp for holding the pipeline suspended from the vessel,
- the clamp is located in the firing line, and comprises a support device constructed and arranged to allow the clamp to hold the pipeline in a first mode wherein the clamp has a fixed position relative to the rest of the pipeline laying system, and in a second mode wherein the clamp is pivotable relative to the rest of the pipeline laying system.

The invention further relates to a method for laying a pipeline on a seabed with a pipeline laying vessel according to any of the invention, wherein the method comprises;

- placing the support device in the first mode when pipeline laying operations are performed, and

- placing the support device in the second mode when no pipeline laying operations are performed.

The invention further relates to a use of a pipeline laying vessel according to the invention.

The invention further relates to a use of a pipeline laying system according to the invention.

Embodiments of the invention will be described by way of example only, with reference to the accompanying schematic drawings in which corresponding reference symbols indicate corresponding parts, and in which:

Figure 1 schematically shows a side view of an embodiment of the pipeline laying
5 vessel according to the invention,

Figure 2 schematically shows a top view of the pipeline laying vessel of fig. 1,

Figure 3 schematically shows an enlarged cross sectional view along line III-III of the pipeline laying system of fig. 2,

Figure 4 schematically shows the pipeline laying system of fig. 2 in the situation that
10 pipeline laying operations are performed,

the Figures 5 and 6 schematically show the pipeline laying system of fig. 2 in the situation that no pipeline laying operations are performed,

the Figures 7 and 8 schematically show an alternative embodiment of the pipeline laying system according the invention,

15 Figure 9 schematically shows a top view of the clamp of the pipeline laying system of fig. 3, and

Figure 10 schematically shows a top view of an alternative embodiment of a clamp of the pipeline laying system according to the invention,

Figure 11 schematically shows a top view of an alternative embodiment of a clamp of
20 the pipeline laying system according to the invention,

Figure 12 schematically shows a top view of the pipeline laying vessel of the alternative embodiments of the figures 10 and 11.

Figure 1 shows an embodiment of the pipeline laying vessel according to the invention. The pipeline laying vessel 2 for laying a pipeline 5 on a seabed 35 is floating on
25 the surface of the sea 36. The horizontal direction 21 and vertical direction 22 are indicated by arrows. The vessel 2 comprises a hull 4. A deck 28 forms the upper part of the hull 4. The vessel 2 comprises a positioning device 6 for positioning a pipe section 7 in a firing line 3 along which the pipeline 5 is laid. The positioning device 6 is supported by the hull 8. More specifically, the positioning device 6 is supported by the deck 28 of the hull 8.

30 The positioning device 6 comprises a tower 33 for holding the pipe section 7 in the firing line 6, which tower 33 extends upwardly from the deck 28. The positioning device 6 further comprises a loader 32 for moving the pipe section 7 from the deck 28 into the tower 33 by pivoting along arrow 27. The tower 33 and loader 32 are constructed and arranged for J-lay.

35 In an alternative embodiment, the positioning device 6 may comprise a reel-lay tower where longer pipe sections are fed into the tower from a reel.

In an alternative embodiment, the positioning device 6 may comprise a substantially horizontal extending structure constructed and arranged for S-lay.

The vessel 2 further comprises a clamp 17 for holding the pipeline 5 suspended from the vessel 2. The clamp 17 is located in the firing line 3 and comprises a support device 18
5 constructed and arranged to allow the clamp 17 to hold the pipeline 5 in a first mode 51 wherein the clamp 17 has a fixed position 53 relative to the positioning device 6 (see fig. 4), and in a second mode 52 wherein the clamp 17 is pivotable relative to the positioning device 6 (see fig. 5 and 6).

The positioning device 6 and the clamp 17 are part of the pipeline laying system 1
10 provided on the pipeline laying vessel 2. A stinger 20 is connected to a lower part of the clamp 17. A workstation 16 with walls 29 is provided on the vessel 2. The clamp 17 is located under the workstation 16. A work floor 39 is provided to create access to the top of the pipeline 5. The clamp shown in fig. 1 is often referred to as hang-off clamp.

In the first mode 51, the clamp 17 has a fixed position 53 relative to the positioning
15 device 6. This allows an accurate and stable alignment of the pipe section 7 and the pipeline 5, which is required for connecting the pipe section 7 held by the positioning device 6 to the pipeline 5 held by the clamp 17. In the first mode 51, movements of the vessel 2 are transferred to pipeline 5 held by the clamp 17. This results in stresses and strains in the pipeline 5, which have a negative effect on the condition of the pipeline 5.

When no pipeline laying operations are performed on the vessel 2, the support device
20 18 is placed in the second mode 52. In the second mode 52, the clamp 17 is pivotable relative to the positioning device 6. Due to this, movements of the vessel 2 are not or at least in reduced form transferred to the pipeline 5 held by the clamp 17. This way, the pipeline 5 is subjected to no or at least lesser stresses and strains. As a result of this, the condition of the
25 pipeline 5 is not or at least less affected.

With the pipeline laying vessel 2 according the invention it will be less often required that the weather condition are that bad that the pipeline 5 needs to be abandoned. This results in a reduced loss of production time due to bad weather conditions.

Due to the fact that in the second mode 52 the clamp 17 is pivotable relative to the
30 positioning device 6 (in the shown situation, the tower 33 and the loader 32), a small number of parts is moving relative to the rest of the vessel 22 for compensating the movements of the vessel 22. If for instance the clamp 17 and the positioning system 6 (tower 33 and loader 32) together were pivotable relative to the rest of the vessel 2, there would be a far larger number of moving parts. A larger number of moving parts makes a system more complex. In
35 addition, a system with a larger number of moving parts is subjected to an increased wear.

Furthermore, due to the fact that in the second mode 52 the clamp 17 is pivotable relative to the positioning device 6 (tower 33 and loader 32), a relatively small mass has to

move relative to the rest of the vessel 2 for compensating the movements of the vessel 2. If for instance the clamp 17 and the positioning system 6 (tower 33 and loader 32) together were pivotable relative to the rest of the vessel 2, a far larger mass would have to move. Due to the inertia of mass, the pipeline 5 is subjected to smaller stresses and strains when a smaller mass has to move for compensating the movements of the vessel 2 than in the situations that a larger mass has to move. Therefore, in the pipeline laying vessel 2 according to the invention the stresses and strains to which the pipeline 5 held by the clamp are subjected are minimized.

With a light mass to be moved, even the pipe line 5 itself can move the clamp 17. In that case no active motion compensation system will be needed as is the case when the clamp 17 and the positioning system 6 (tower 33 and loader 32) would be pivotable relative to the rest of the vessel 2.

Figure 2 shows a top view of the pipeline laying vessel of fig. 1. The roll axis 40 together with the roll movement 401 and the pitch axis 41 together with the pitch movement 411 are indicated. The clamp 17 is in the second mode 52 pivotable about a first pivot axis 42. The first pivot axis 42 extends substantially parallel to the roll axis 40 of the vessel 2. The tower 33 can be moved about the pivot axis 34 relative to the hull 4 to determine the orientation of the firing line 3 along which the pipeline 5 is laid. The angle which the firing line 3 makes with the horizontal strongly depends on the water depth in which the pipeline 5 is laid. In very deep waters, said angle will be around 90° . In more shallow waters, said angle will be smaller.

Figure 3 shows an enlarged cross sectional view along line III-III of the pipeline laying system of fig. 2. The tower 33 is supported by the deck 28 via two tower hinges 37 allowing the tower 33 to pivot about the tower pivot axis 34 in order to position the firing line 3. The clamp 17 is located at the underside of the workstation 16. A small part of the clamp 17 is located inside the workstation 16.

The clamp 17 comprises a base structure 30 which is supported by the hull 4, more specifically by the deck 28. In an alternative embodiment, the base structure 30 may (also) be supported by the positioning device 6, more specifically by the tower 33. The base structure 30 is supported via a slide support 38 allowing the clamp 17 to be moved into an inoperative position at a distance of the firing line 3. This is for example used to allow the passage of a bulky item, such as an inline structure. The clamp 17 holding the pipeline 5 is located in an operative position in the firing line 3.

The clamp 17 comprises a clamp unit 19 for clamping the pipeline. The pipeline 5 comprises a collar 31 and the clamp unit 19 is a collar clamp unit for engaging a collar 31. In an alternative embodiment, the clamp unit 19 may be a friction clamp unit comprising friction elements engaging the pipeline 5.

The clamp unit 19 is attached to the base structure 30 via the support device 18. The support device 18 is constructed and arranged to allow the clamp unit 19 to clamp the pipeline 5 in the first mode 51 wherein the clamp unit 19 has a fixed position 53 relative to the positioning device 6 and the base structure 30 and in the second mode 52 wherein the clamp unit 19 is pivotable relative to the positioning device 6 and the base structure 30 (see fig. 4-6).

Due to the fact that in the second mode 52 the clamp unit 19 is pivotable relative to the positioning device 6 and the base structure 30, a small mass is moving relative to the rest of the vessel 2 for compensating the movements of the vessel 2.

Furthermore, due to the fact that in the second mode 52 the clamp unit 19 is pivotable relative to the positioning device 6 and the base structure 30, a small number of parts moving relative to the rest of the vessel 2 for compensating the movements of the vessel 2.

The support device 18 comprises a first hydraulic cylinder 8 and a second hydraulic cylinder 9, which both support the clamp unit. In an alternative embodiment, the hydraulic cylinders 8, 9 may support a different part and/or additional parts of the clamp 17 or the entire clamp 17.

The first and second hydraulic cylinders 8, 9 are interconnected by a first hydraulic fluid connection 13. In the first mode 51 the first hydraulic fluid connection 13 is closed by closing the first valve 10 to prevent that hydraulic fluid 23 flows from one of the first and second hydraulic cylinder 8, 9 to the other of the first and second hydraulic cylinder 8, 9. In the second mode 52 the first hydraulic fluid connection 13 is open by opening the first valve 10 to allow that hydraulic fluid 23 flows from one of the first and second hydraulic cylinder 8, 9 to the other of the first and second hydraulic cylinder 8, 9.

A control unit 26 is connected to the first valve 10 via a first communication line 46 for controlling the opening and closing of the first valve 10.

The first hydraulic cylinders 8 is connected to a hydraulic fluid supply 25 via a second hydraulic fluid connection 14 comprising a second valve 11 for opening and closing the second hydraulic fluid connection 14. The second hydraulic cylinders 9 is connected to the hydraulic fluid supply 25 via a third hydraulic fluid connection 15 comprising a third valve 12 for opening and closing the third hydraulic fluid connection 15.

The control unit 26 is connected to the second valve 11 via a second communication line 47 and to the third valve 12 via a third communication line 48 for controlling the opening and closing of the second and third valve 11, 12.

In an alternative embodiment a hinge may be used to allow the clamp 17 to pivot about the first pivot axis 42 in stead of hydraulic cylinders 8, 9.

In an alternative embodiment a spring element may be used to allow the clamp 17 to pivot about the first pivot axis 42 in stead of hydraulic cylinders 8, 9.

Figure 4 shows the pipeline laying system of fig. 2 in the situation that pipeline laying operations are performed. The support device 30 is placed in the first mode 51. The clamp unit 3 is located in a fixed position 53 relative to the positioning device 6 and the base structure 30. A pipe section 7 is positioned in line with the pipeline 5 for connection thereto. In the situation shown, the vessel 2 is subjected to a clockwise roll movement 401 about the roll axis 40. The positioning device 6, the base structure 30 and the clamp unit 19 are moved such that they are positioned under an angle relative to the horizontal 21.

Figures 5 and 6 schematically show the pipeline laying system of fig. 2 in the situation that no pipeline laying operations are performed. The support device 30 is placed in the second mode 52. The clamp unit 3 is pivotable relative to the positioning device 6 and the base structure 30. In the situation shown in fig. 5, the vessel 2 is subjected to a clockwise roll movement 401 about the roll axis 40. The positioning device 6 and the base structure 30 are moved such that they are positioned under an angle relative to the horizontal 21. The clamp unit 19 holding the pipeline is pivoted about the first pivot axis 42 relative to the positioning device 6 and the base structure 30 and remains in a substantially horizontal position. In the situation shown in fig. 6, the vessel 2 is subjected to a counter clockwise roll movement 401 about the roll axis 40. The positioning device 6 and the base structure 30 are moved such that they are positioned under an angle relative to the horizontal 21. The clamp unit 19 holding the pipeline is pivoted about the first pivot axis 42 relative to the positioning device 6 and the base structure 30 and remains in a substantially horizontal position.

The figures 7 and 8 show an alternative embodiment of the pipeline laying system according to the invention. The support device 18 comprises a rigid support member 60. The rigid support member 60 comprises a first support surface 62. The clamp unit 19 comprises a second support surface 63. The two hydraulic cylinders 8, 9 are interconnected by an open hydraulic fluid connection 13. The open hydraulic fluid connection 13 is connected to the hydraulic fluid supply 25 via a controllable hydraulic fluid connection 14. A valve 11 is provided to open or close the controllable hydraulic fluid connection 14. The opening and closing of said valve 11 is controlled by control unit 26 which is connected to said valve 11 via a communication line 47. The hydraulic fluid supply 25 and the control unit 26 are constructed and arranged to tap hydraulic fluid 23 from the hydraulic cylinders 8, 9 and to add hydraulic fluid 23 to the hydraulic cylinders 8, 9. Other configurations to tap and add hydraulic fluid are possible.

In figure 7, the support device 18 is placed in the second mode 52. Hydraulic fluid 23 is added to the hydraulic cylinders 8, 9 to position the clamp unit 19 at a distance from the

rigid support member 60 to allow the clamp unit 19 to pivot relative to the positioning device 6 and the base structure 30.

In figure 8, the support device 18 is placed in the first mode 51. Hydraulic fluid 23 is tapped from the hydraulic cylinders 8, 9 to lower the clamp unit 19 on the rigid support 60
5 such that the clamp unit 19 has a fixed position 53 relative to the positioning device 6 and the base structure 30. The clamp unit 19 is in the first mode 51 supported by the hull 4, more specifically the deck 28 of the hull 4, via the rigid support member 60. In the first mode 51 the second support surface 63 is positioned on the first support surface 62. This way a fixed and stable position of the clamp unit 19 is ensured during pipeline laying operations.

10 The rigid support member 60 may be connected to or form an integrated part of the base structure 30 or the positioning device 6.

Figure 9 shows a top view of the clamp of the pipeline laying system of fig. 3. The first and second hydraulic cylinder 8, 9 are located at a distance from each other and the first pivot axis 42 extends between the first and second hydraulic cylinder 8, 9.

15 Figure 10 shows a top view of an alternative embodiment of a clamp of the pipeline laying system according to the invention. The support device comprises a first, second and third hydraulic cylinders 8, 9, 50 located at a distance from each other. The support device 18 is constructed and arranged to compensate for any roll movement and pitch movement of the vessel 2. The support device 18 in the second mode 52 in fact comprises a second pivot
20 axis 43 extending substantially parallel to the pitch axis 41 of the vessel 2.

In an alternative embodiment, hinges may be used in stead of hydraulic cylinders 8, 9, to provide a cardanic construction to allow the clamp 17 to pivot about the first pivot axis 42 and the second pivot axis 43.

In an alternative embodiment spring elements may be used in stead of hydraulic
25 cylinders 8, 9 to allow the clamp 17 to pivot about the first pivot axis 42 and the second pivot axis 43.

Figure 11 schematically shows a top view of an alternative embodiment of a clamp of the pipeline laying system according to the invention. The support device 18 comprises nine hydraulic cylinders 8, 9, 50 located at distances from each other. The support device 18 is
30 constructed and arranged to compensate for any roll movement and pitch movement of the vessel 2.

In the embodiments of fig. 10 and 11, the hydraulic cylinders 8, 9, 50 are positioned along a circle.

Figure 12 schematically shows a top view of the pipeline laying vessel of the
35 alternative embodiments of the figures 10 and 11. The roll axis 40 together with the roll movement 401 and the pitch axis 41 together with the pitch movement 411 are indicated. The clamp 17 is in the second mode 52 pivotable about the first pivot axis 42 and the second

second pivot axis 43. The first pivot axis 42 extends substantially parallel to the roll axis 40 of the vessel 2. The second pivot axis 43 extends substantially parallel to the pitch axis 41 of the vessel 2.

It will be apparent to those skilled in the art that various modifications can be made to
5 the invention without departing from the scope of the invention.

Claims

1. Pipeline laying vessel for laying a pipeline on a seabed, which pipeline laying vessel comprises;
 - a hull,
 - a positioning device for positioning a pipe section in a firing line along which the pipeline
 - 5 is laid, which positioning device is supported by the hull, and
 - a clamp for holding the pipeline suspended from the vessel, wherein
 - the clamp is located in the firing line, and comprises a support device constructed and
 - arranged to allow the clamp to hold the pipeline in a first mode wherein the clamp has a
 - fixed position relative to the positioning device, and in a second mode wherein the clamp
 - 10 is pivotable relative to the positioning device.
2. Pipeline laying vessel according to claim 1, wherein the clamp in the second mode is pivotable about a first pivot axis.
- 15 3. Pipeline laying vessel according to claim 2, wherein the first pivot axis extends substantially parallel to a roll axis of the vessel.
4. Pipeline laying vessel according to any of the preceding claims, wherein the clamp in the second mode is pivotable about a second pivot axis.
- 20 5. Pipeline laying vessel according to claim 4, wherein the second pivot axis extends substantially parallel to a pitch axis of the vessel.
6. Pipeline laying vessel according to claim 4 or 5, wherein the first pivot axis and the
- 25 second pivot axis extend transverse, preferably substantially perpendicular, to each other.
7. Pipeline laying vessel according to any of the preceding claims, wherein the clamp in the second mode is pivotable over an angle of at least 2 degrees relative to the horizontal.
- 30 8. Pipeline laying vessel according to any of the preceding claims, wherein the clamp in the second mode is pivotable over an angle of at least 5 degrees relative to the horizontal.
9. Pipeline laying vessel according to any of the preceding claims, wherein the support
- 35 device is constructed and arranged to switch from the first mode to the second mode,

and vice versa.

10. Pipeline laying vessel according to any of the preceding claims, wherein the support device comprises a control unit constructed and arranged to control switching from the first mode to the second mode, and vice versa.
11. Pipeline laying vessel according to any of the preceding claims, wherein the support device comprises a rigid support member and at least part of the clamp is in the first mode supported by the hull or the positioning device via the rigid support member.
12. Pipeline laying vessel according to claim 11, wherein the rigid support member comprises a first support surface, the clamp comprises a second support surface and in the first mode the second support surface is positioned on the first support surface.
13. Pipeline laying vessel according to claim 12, wherein in the second mode the first support surface is positioned at a distance from the second support surface to allow the clamp to pivot relative to the positioning device.
14. Pipeline laying vessel according to any of the preceding claims, wherein the support device comprises at least one spring element supporting at least part of the clamp.
15. Pipeline laying vessel according to any of the preceding claims, wherein the support device comprises at least one hinge supporting at least part of the clamp.
16. Pipeline laying vessel according to any of the preceding claims, wherein the support device comprises two hydraulic cylinders comprising hydraulic fluid and supporting at least part of the clamp.
17. Pipeline laying vessel according to any of the claims 1-15, wherein the support device comprises at least three hydraulic cylinders comprising hydraulic fluid and supporting at least part of the clamp.
18. Pipeline laying vessel according to any of the preceding claims, wherein in the first mode a flow of hydraulic fluid in and out the hydraulic cylinders is blocked to support the clamp in a fixed position relative to the positioning device.

19. Pipeline laying vessel according to any of the preceding claims, wherein in the second mode a flow of hydraulic fluid in and out the hydraulic cylinders is allowed to support the clamp such that the clamp is pivotable relative to the positioning device.

5 20. Pipeline laying vessel according to any of the preceding claims, wherein in the second mode a flow of hydraulic fluid between the hydraulic cylinders is allowed to support the clamp such that the clamp is pivotable relative to the positioning device.

21. Pipeline laying vessel according to any of the claims 11-17, wherein

- 10 - in the first mode hydraulic fluid is tapped from the hydraulic cylinders to position the clamp on the rigid support in a fixed position relative to the positioning device, and
- in the second mode hydraulic fluid is added to the hydraulic cylinders to position the clamp at a distance from the rigid support and to allow the clamp to pivot relative to the positioning device.

15

22. Pipeline laying vessel according to any of the preceding claims, wherein

- the clamp comprises a base structure supported by the hull and/or the positioning device,
- the clamp comprises a clamp unit for clamping the pipeline,
20 - the clamp unit is attached to the base structure, and
- the support device is constructed and arranged to allow the clamp unit to clamp the pipeline in the first mode wherein the clamp unit has a fixed position relative to the positioning device and the base structure and in the second mode wherein the clamp unit is pivotable relative to the positioning device and the base structure.

25

23. Pipeline laying vessel according to any of the claims 1-20, 22, wherein

- the support device comprises a first hydraulic cylinder and a second hydraulic cylinder which both support at least part of the clamp,
- the first and second hydraulic cylinders are interconnected by a hydraulic fluid
30 connection,
- in the first mode the hydraulic fluid connection is closed to prevent that hydraulic fluid flows from one of the first and second hydraulic cylinder to the other of the first and second hydraulic cylinder, and
- in the second mode the hydraulic fluid connection is open to allow that hydraulic fluid
35 flows from one of the first and second hydraulic cylinder to the other of the first and second hydraulic cylinder.

24. Pipeline laying vessel according to any of the claims 1-20, 22, wherein

- the support device comprises a first hydraulic cylinder, a second hydraulic cylinder, and a third hydraulic cylinder supporting at least part of the clamp,

- the first, second and third hydraulic cylinders are interconnected by a hydraulic fluid connection,

- in the first mode the hydraulic fluid connection is closed to prevent that hydraulic fluid flows from one of the first, second and third hydraulic cylinder to an other of the first, second and third hydraulic cylinder, and

- in the second mode the hydraulic fluid connection is open allow that hydraulic fluid flows from one of the first, second and third hydraulic cylinder to an other of the first, second and third hydraulic cylinder.

25. Pipeline laying vessel according to any of the preceding claims, wherein the positioning device comprises a tower which in use extends upwardly from the hull.

26. Pipeline laying vessel according to claim 25, wherein the clamp is located near a lower part of the tower.

27. Pipeline laying vessel according to any of the claims 1-24, wherein the positioning device comprises a substantially horizontal extending structure.

28. Pipeline laying vessel according to any of the preceding claims, wherein the clamp is a collar clamp or a friction clamp or a tensioner.

29. Pipeline laying system for laying a pipeline along a firing line and from a pipeline laying vessel comprising a hull, which pipeline laying system comprises;

- a positioning device for in use positioning a pipe section in a firing line along which the pipeline is laid, which positioning device is constructed and arranged to in use be supported by the hull, and

- a clamp for in use holding the pipeline suspended from the vessel, wherein the clamp is located in the firing line, and comprises a support device constructed and arranged to allow the clamp to hold the pipeline in a first mode wherein the clamp has a fixed position relative to the positioning device, and in a second mode wherein the clamp is pivotable relative to the positioning device.

30. Pipeline laying system according to claim 29, comprising the features of any of the claims 1-28.

31. Pipeline laying vessel for laying a pipeline on a seabed, which pipeline laying vessel

5 comprises;

- a hull,

- a pipeline laying system for laying the pipeline along a firing line, which pipeline laying system is supported by the hull, and comprises a clamp for holding the pipeline suspended from the vessel, the clamp is located in the firing line, and comprises a

10 support device constructed and arranged to allow the clamp to hold the pipeline in a first mode wherein the clamp has a fixed position relative to the rest of the pipeline laying system, and in a second mode wherein the clamp is pivotable relative to the rest of the pipeline laying system.

15 32. Pipeline laying vessel according to claim 31, wherein the pipeline laying system comprises a positioning device for positioning a pipe section in the firing line.

33. Pipeline laying vessel according to claim 31 or 32, wherein the pipeline laying vessel comprises the features of any of the claims 1-28.

20

34. Pipeline laying system for laying a pipeline along a firing line and from a pipeline laying vessel comprising a hull, wherein

- the pipeline laying system is constructed and arranged to in use be supported by the hull and comprises a clamp for holding the pipeline suspended from the vessel,

25 - the clamp is located in the firing line, and comprises a support device constructed and arranged to allow the clamp to hold the pipeline in a first mode wherein the clamp has a fixed position relative to the rest of the pipeline laying system, and in a second mode wherein the clamp is pivotable relative to the rest of the pipeline laying system.

30 35. Pipeline laying system according to claim 34, wherein the pipeline laying system comprises a positioning device for positioning a pipe section in the firing line.

36. Pipeline laying system according to claim 34 or 35, comprising the features of any of the claims 1-28.

35

37. Method for laying a pipeline on a seabed with a pipeline laying vessel according to any of the claims 1-28 or 31-33, wherein the method comprises;

- placing the support device in the first mode when pipeline laying operations are performed, and
- placing the support device in the second mode when no pipeline laying operations are performed.

5

38. Method according to claim 37, wherein the method comprise placing the support device in the first mode by blocking a flow of hydraulic fluid in and out the hydraulic cylinders.

39. Method according to claim 37 or 38, wherein the method comprise placing the support
10 device in the second mode by allowing a flow of hydraulic fluid in and out the hydraulic cylinders.

40. Method according to any of the claims 37-39, wherein the method comprise placing the
15 support device in the second mode by allowing a flow of hydraulic fluid between the hydraulic cylinders.

41. Method according to claim 37, wherein the method comprises;
- placing the support device in the first mode by tapping hydraulic fluid from the hydraulic cylinders to position the clamp on the rigid support in a fixed position relative to the
20 positioning device, and
- placing the support device in the second mode by adding hydraulic fluid to the hydraulic cylinders to position the clamp at a distance from the rigid support and to allow the clamp to pivot relative to the positioning device.

25 42. Use of a pipeline laying vessel according to any of the claims 1-28, 31-33.

43. Use of a pipeline laying system according to any of the claims 29, 30, 34-36.

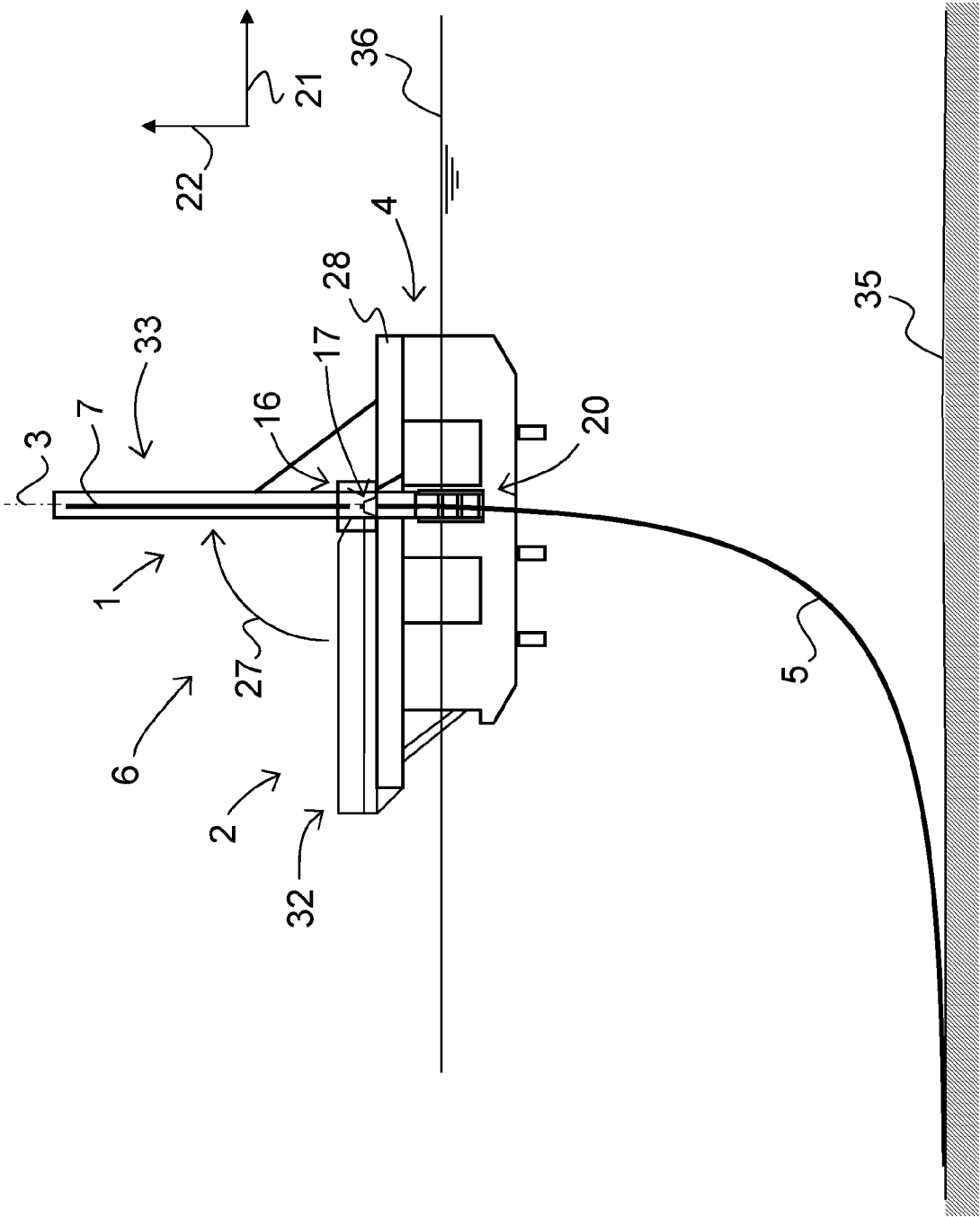


Figure 1

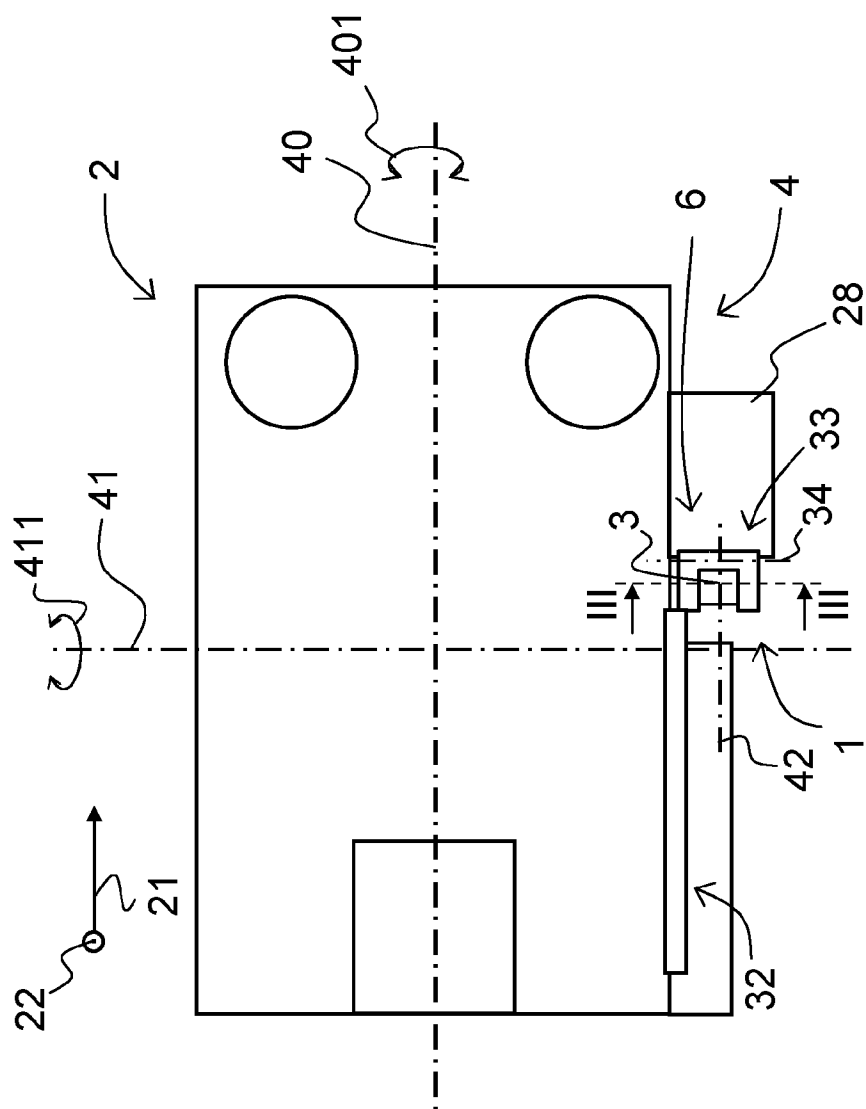


Figure 2

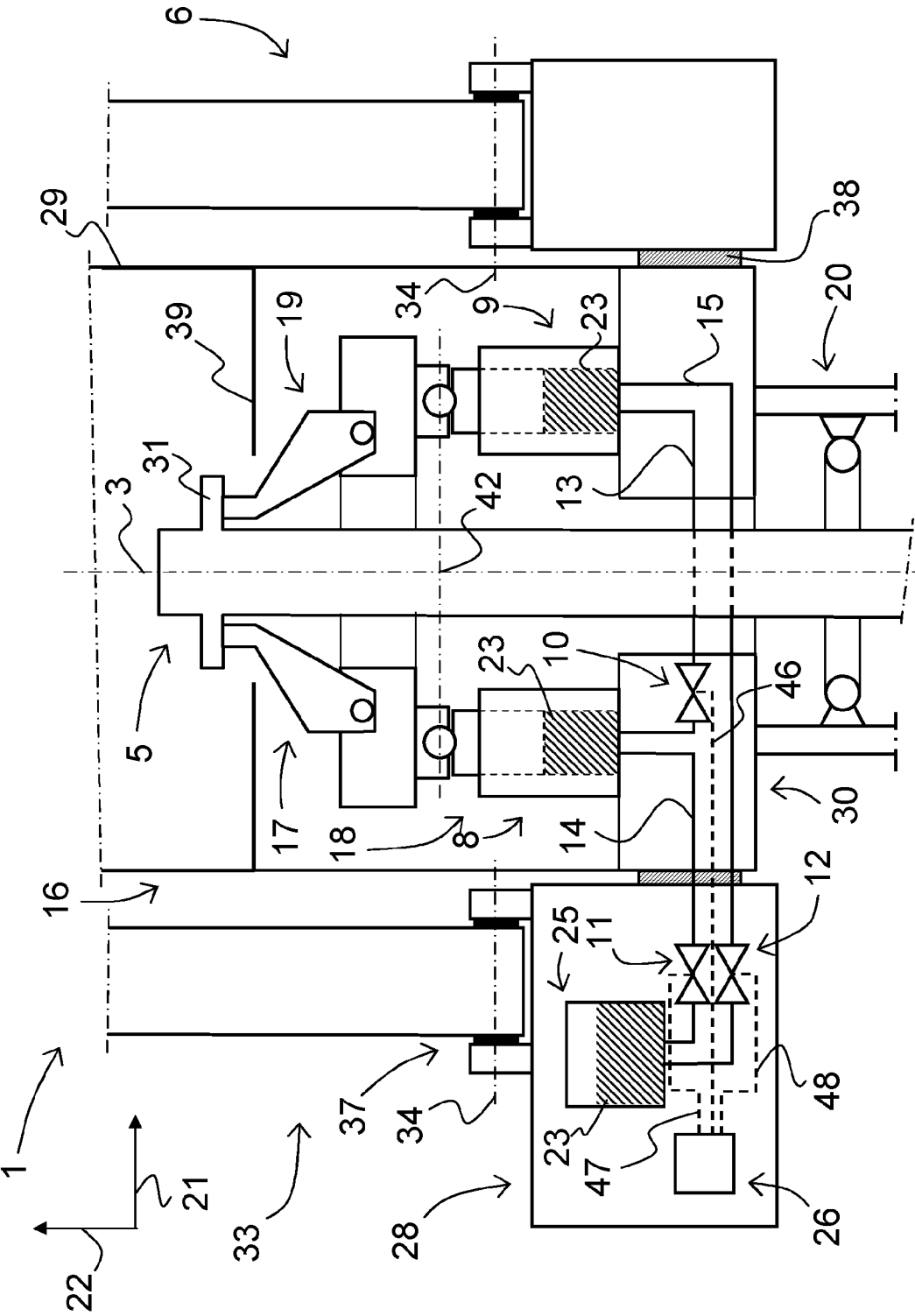


Figure 3

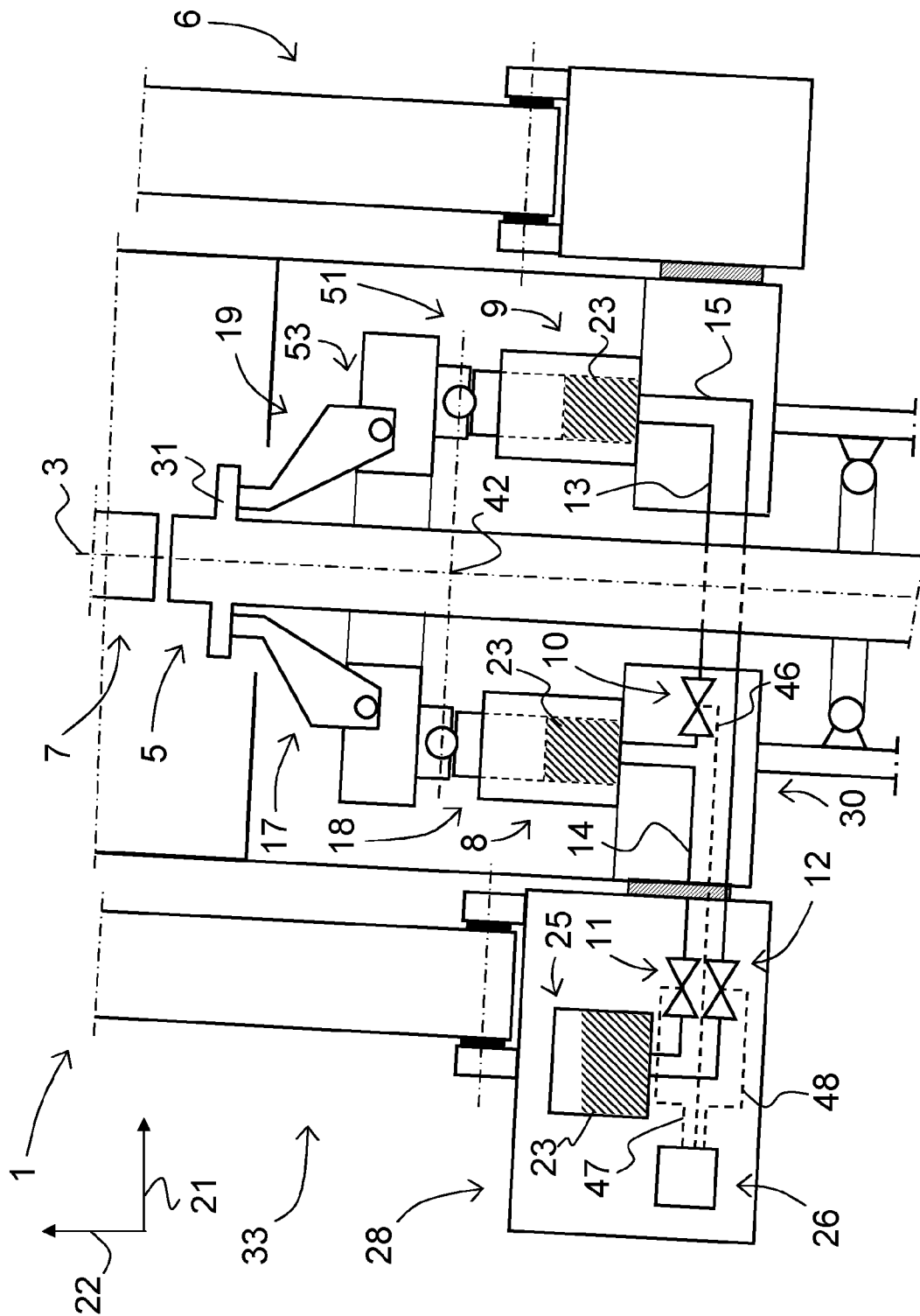


Figure 4

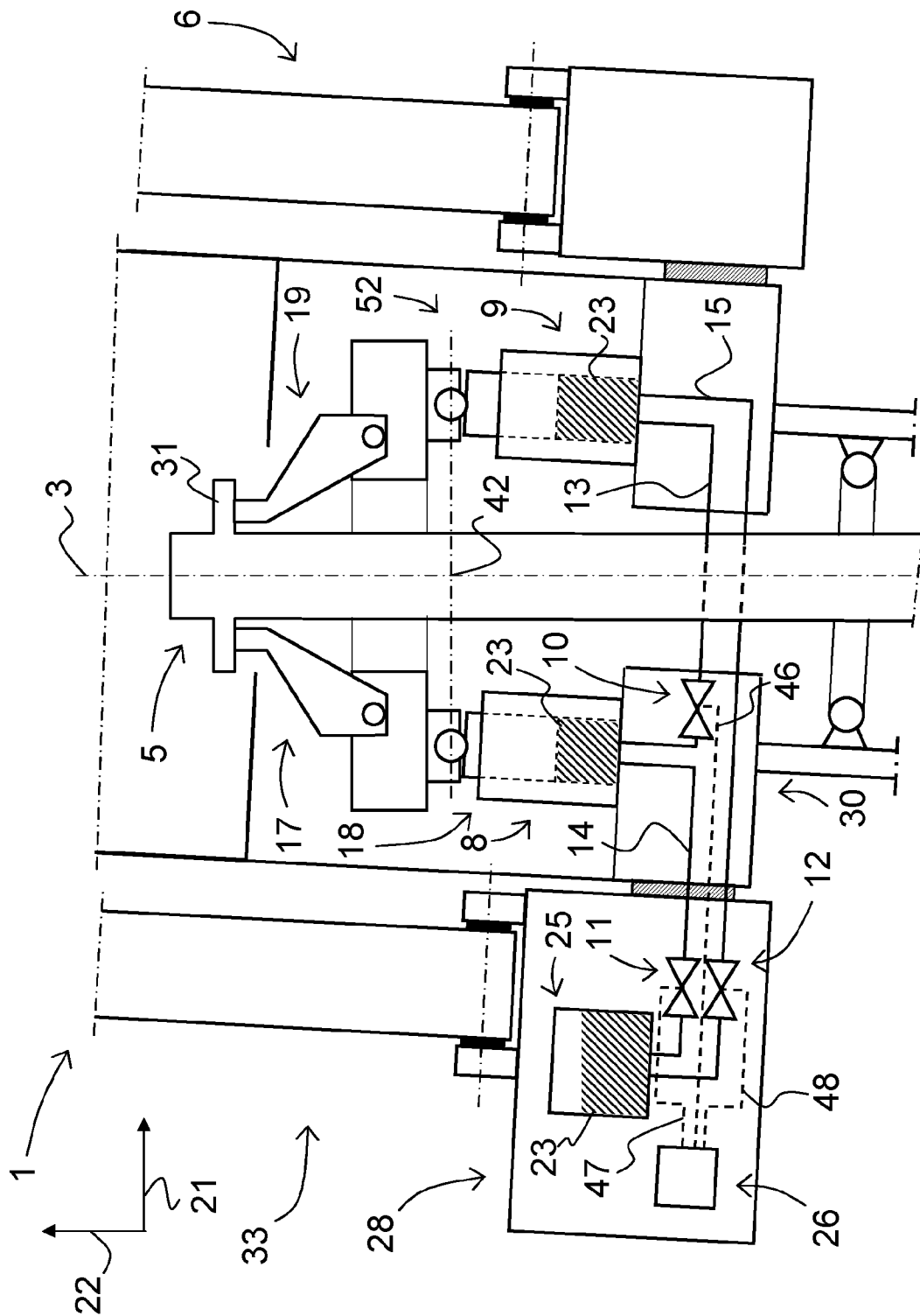


Figure 5

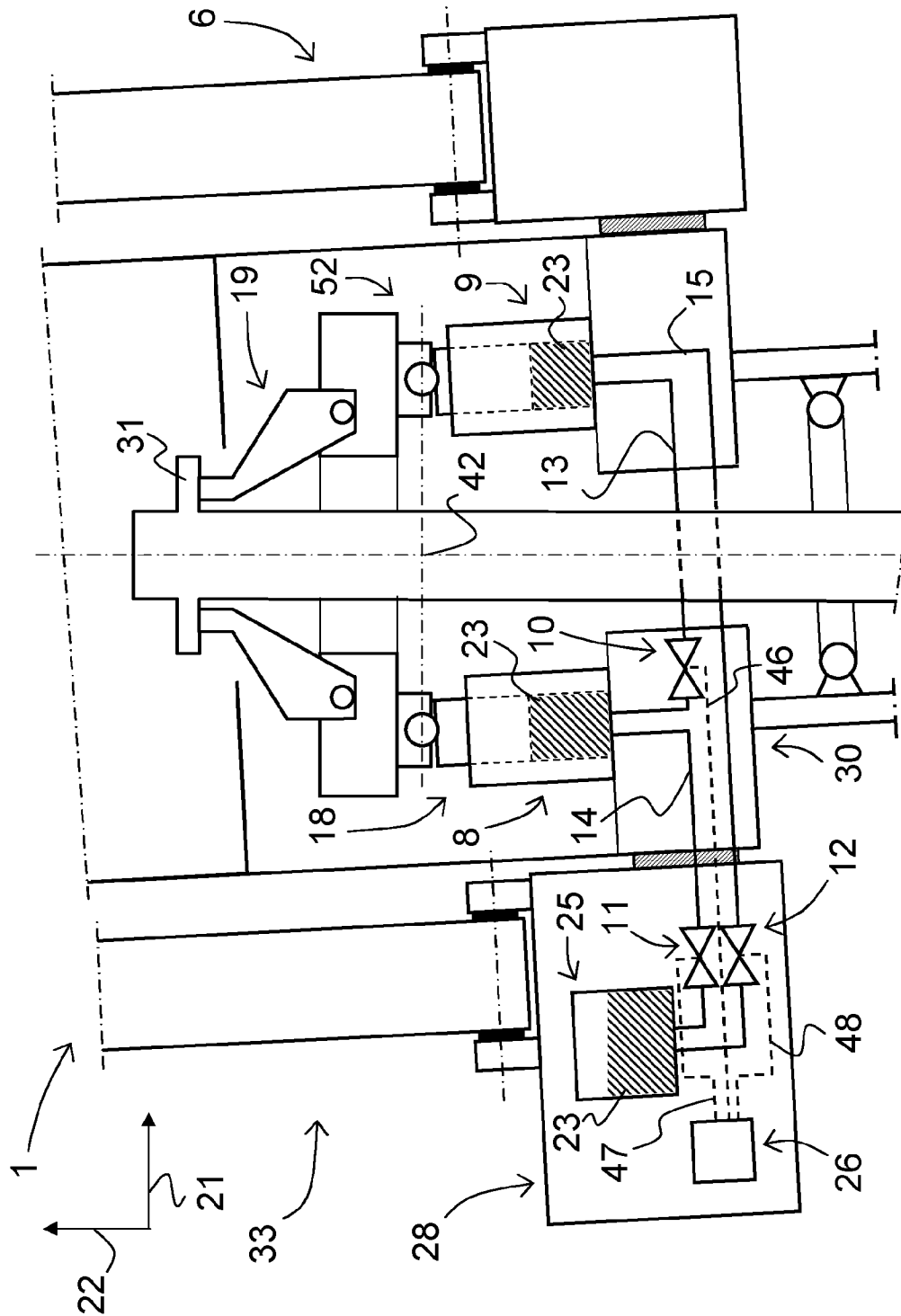


Figure 6

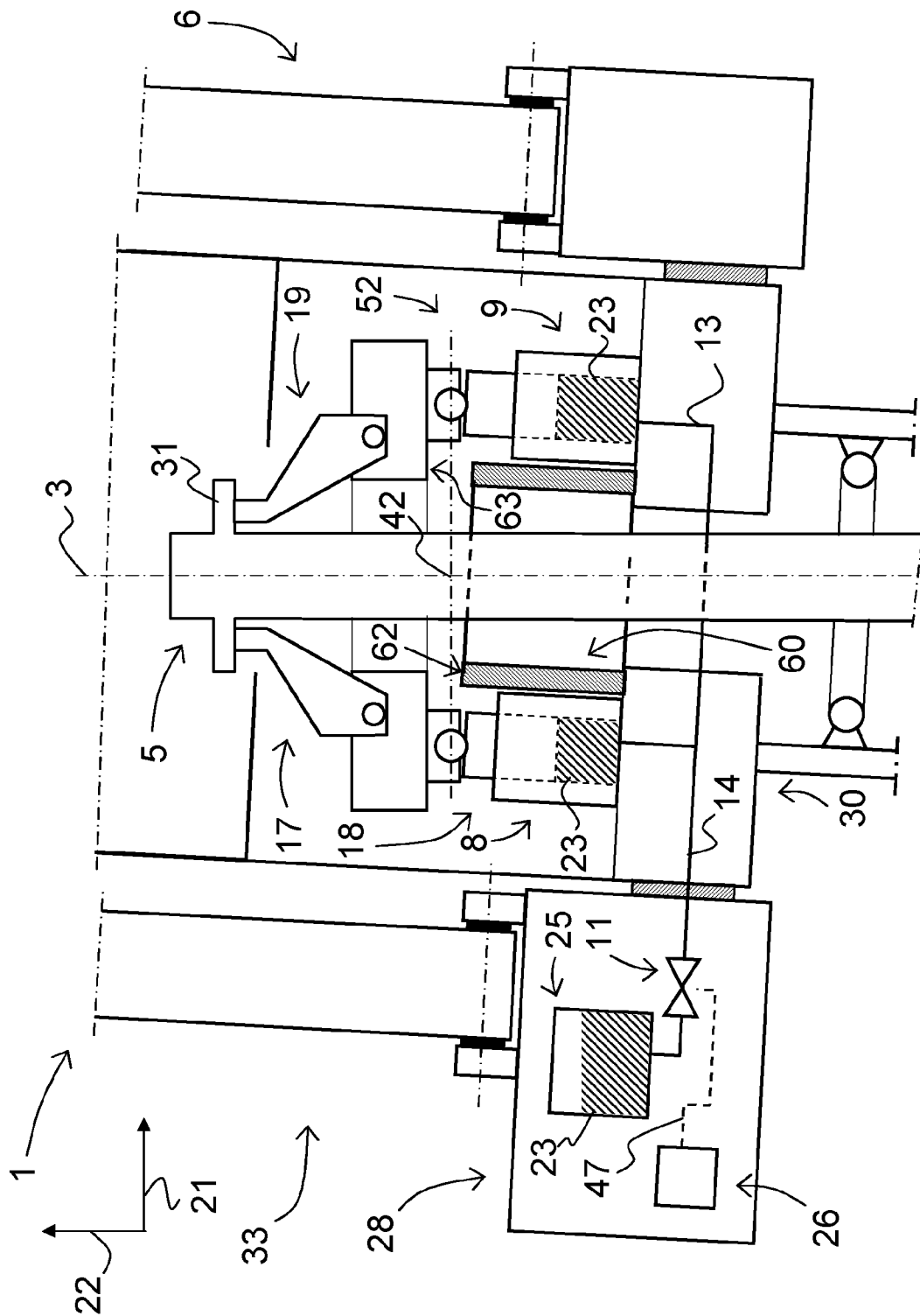


Figure 7

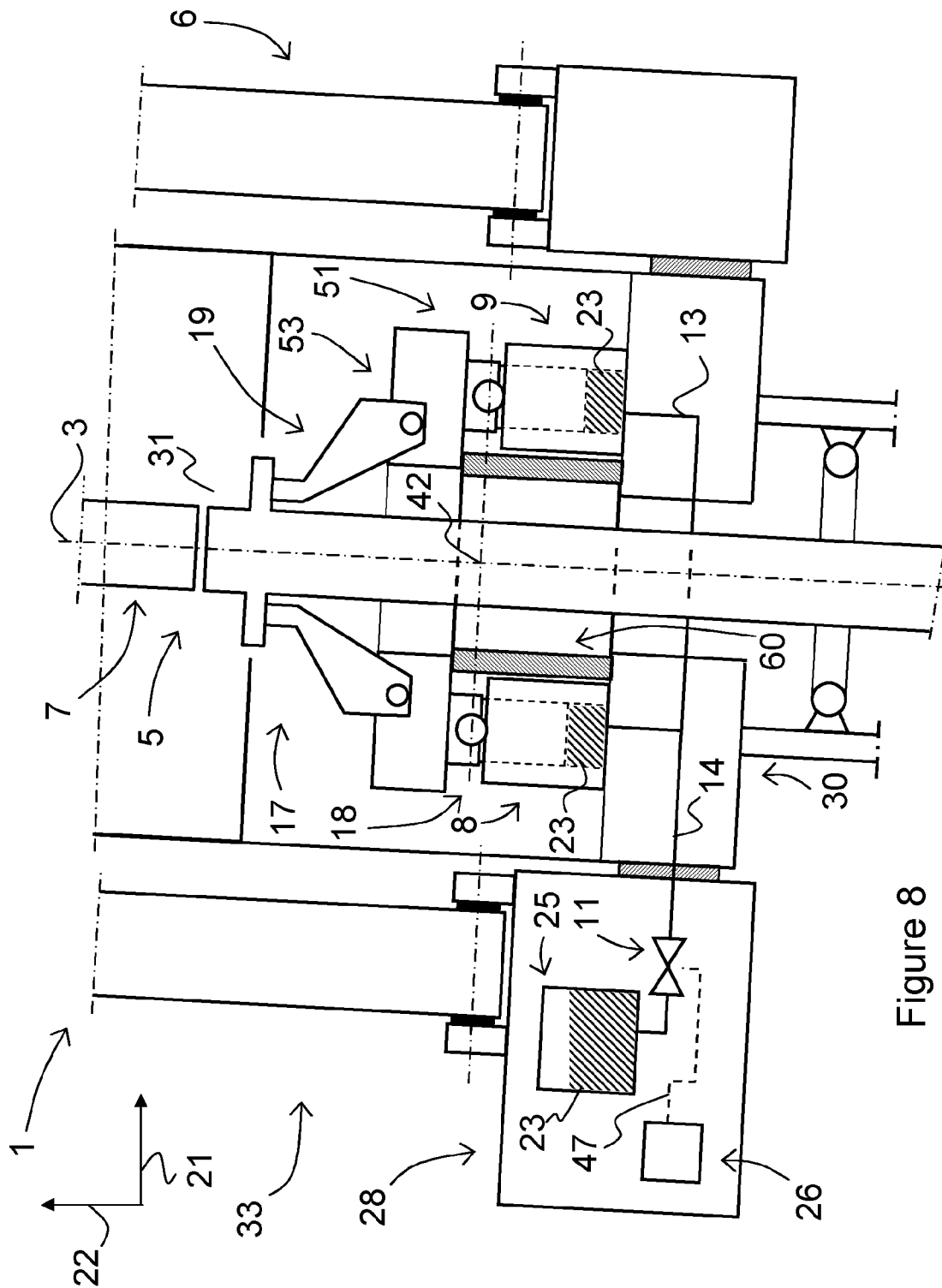


Figure 8

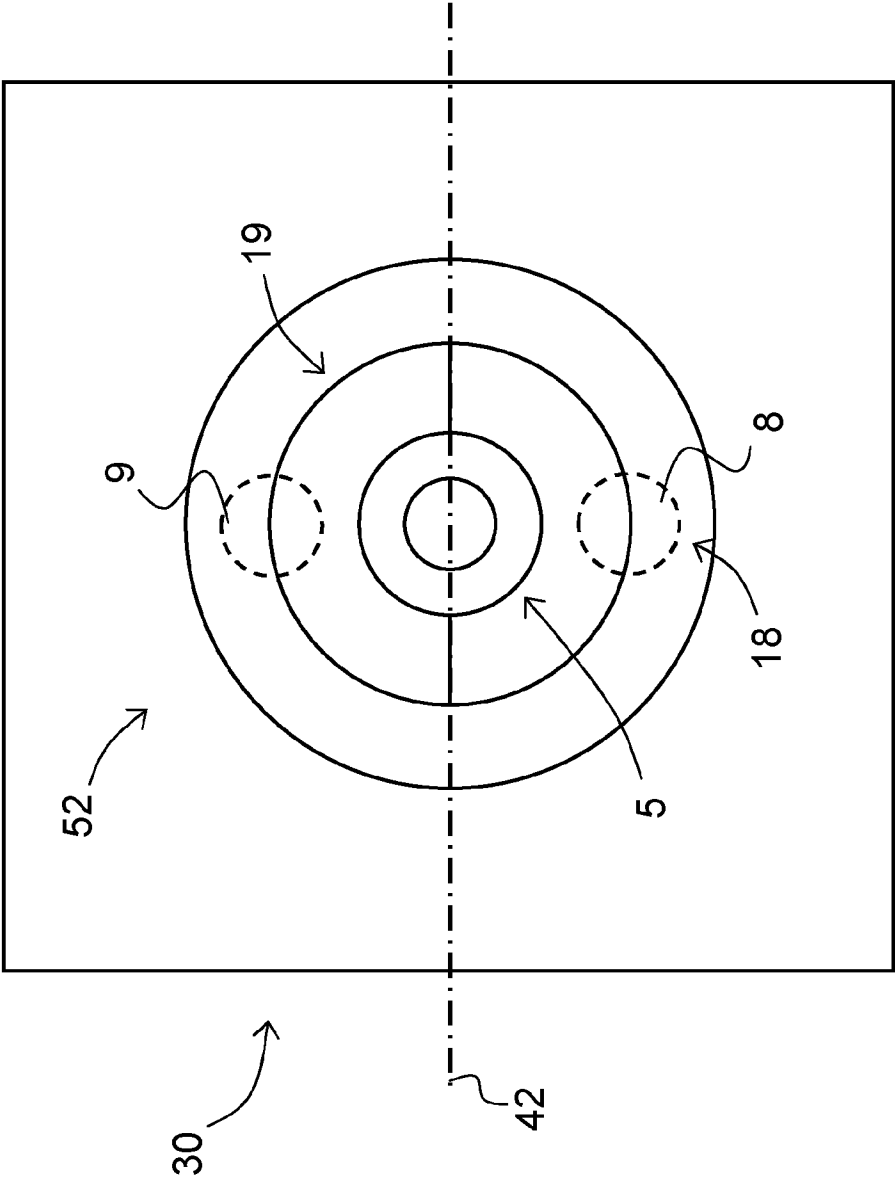


Figure 9

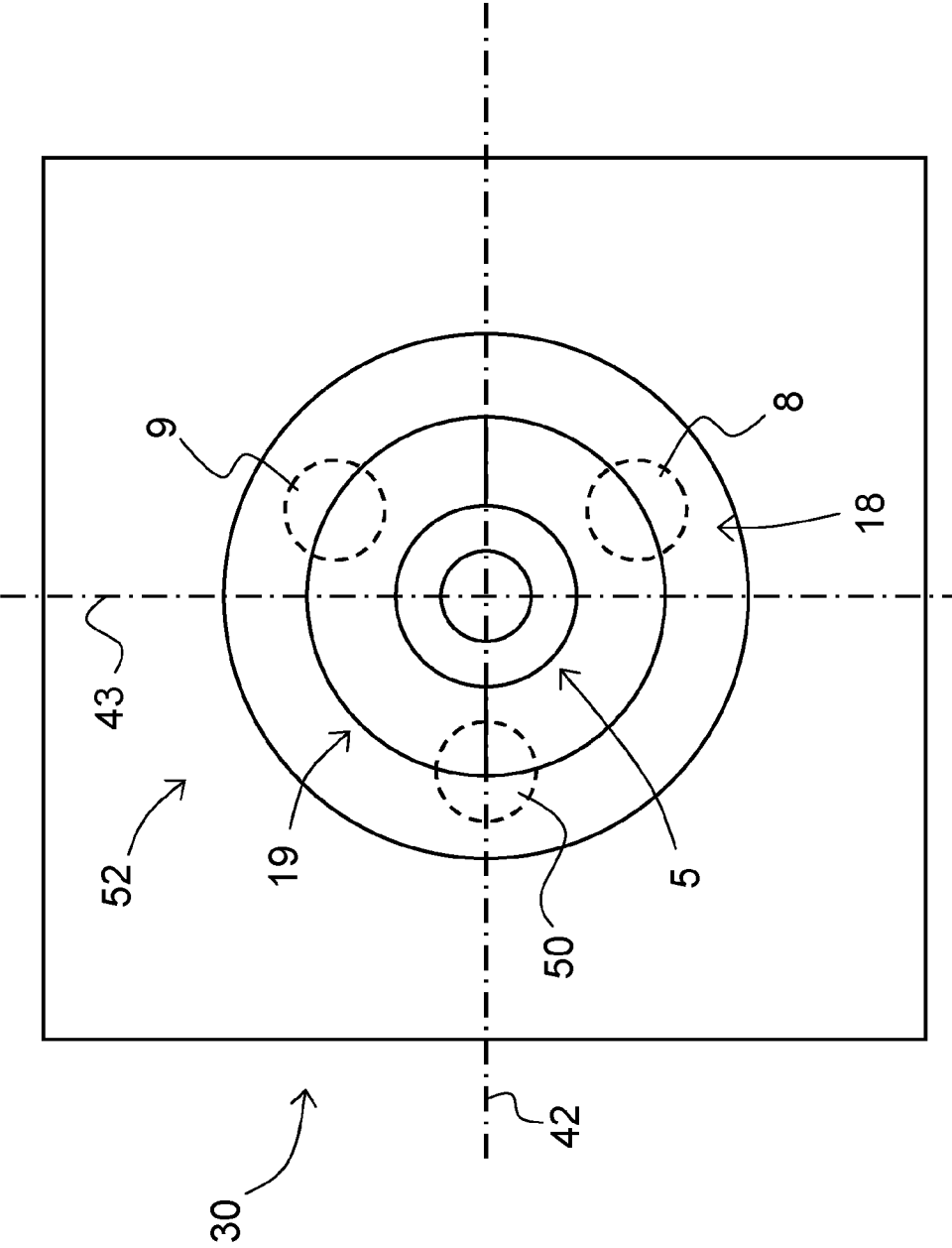


Figure 10

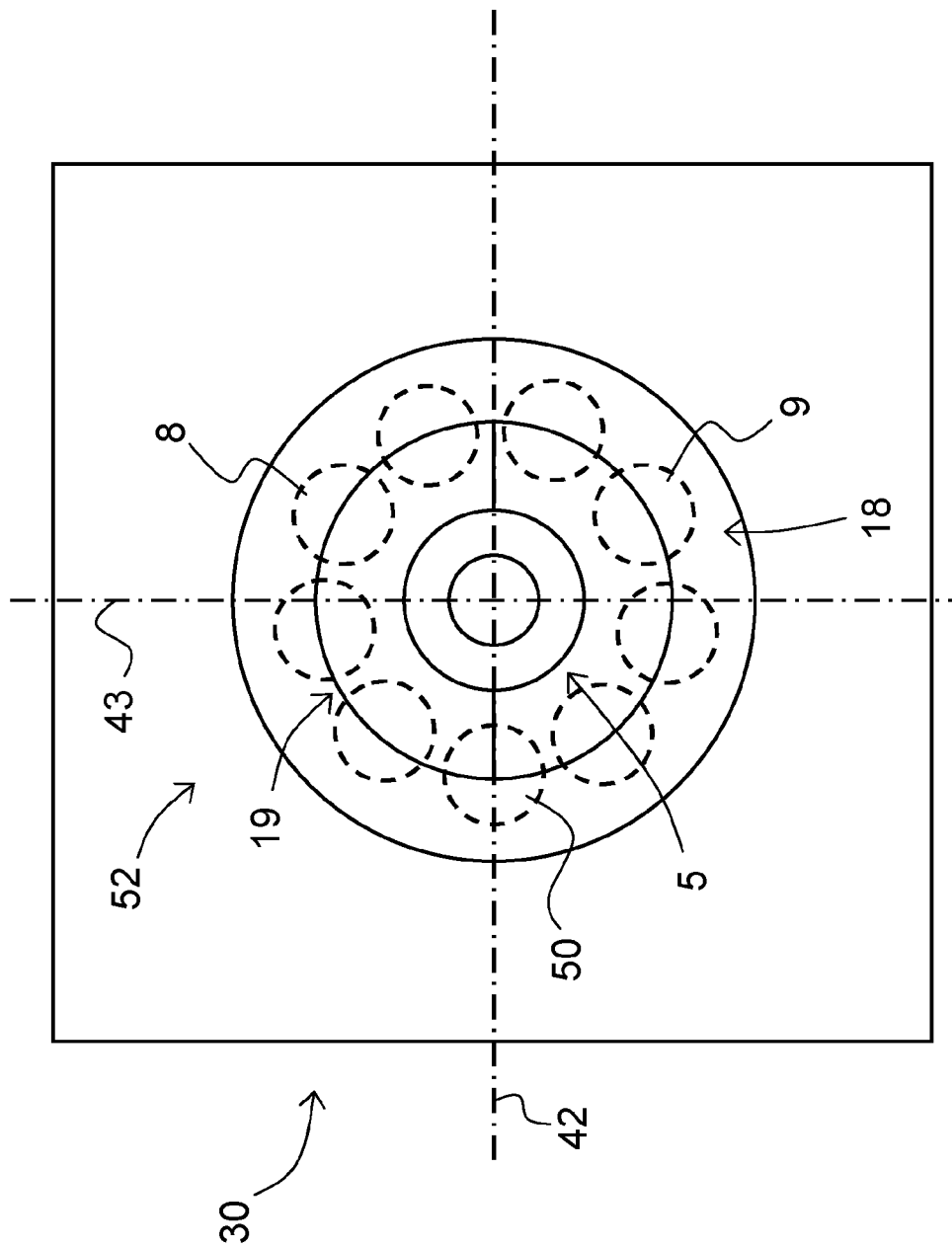


Figure 11

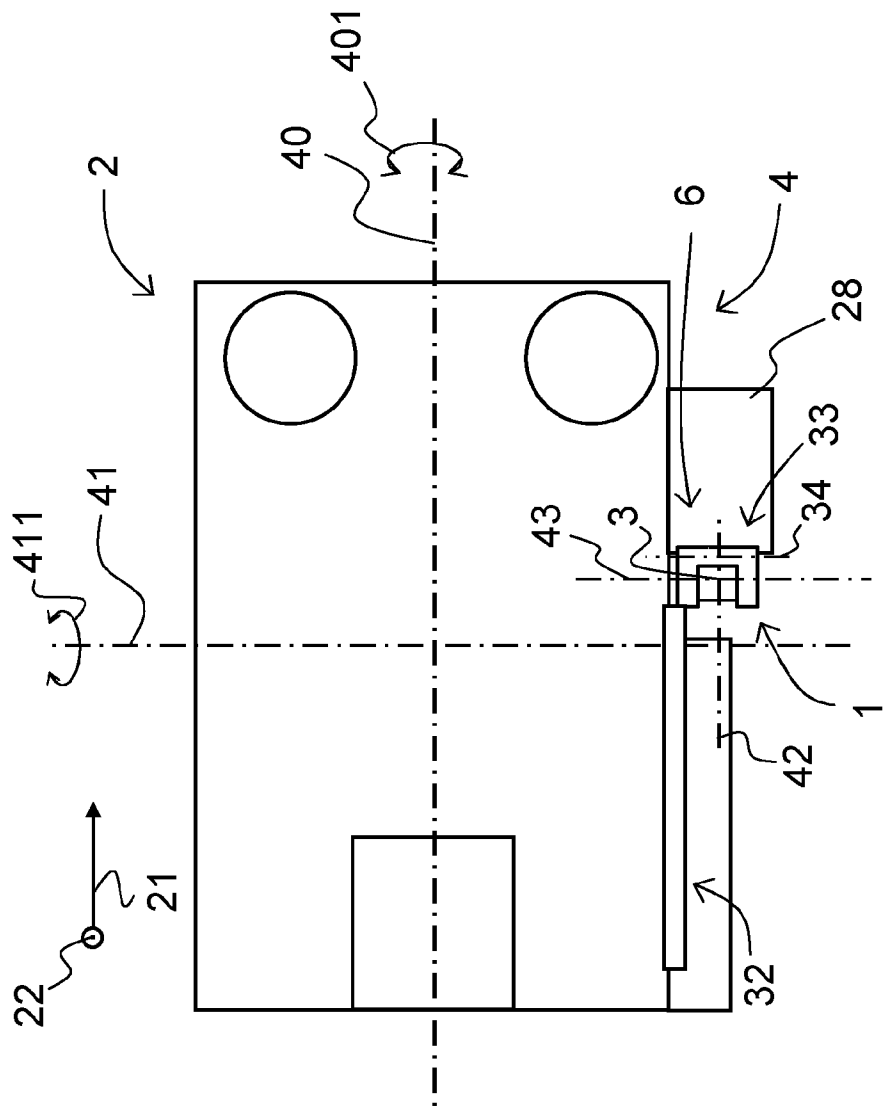


Figure 12

INTERNATIONAL SEARCH REPORT

International application No

PCT/NL2012/050213

A. CLASSIFICATION OF SUBJECT MATTER

INV. F16L1/20

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 030 480 A5 (EXXON RESEARCH ENGINEERING CO) 13 November 1970 (1970-11-13) page 1, line 1 - page 6, line 36; claims 1-10; figures 1-5	1-10, 15-20, 22-40, 42,43
X	US 2010/310319 A1 (PIONETTI FRANCOIS-REGIS [FR]) 9 December 2010 (2010-12-09) paragraph [0001] - paragraph [0149]; claims 1-17; figures 1-6e	1-10,14, 16-20, 22-36, 42,43



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

27 April 2012

Date of mailing of the international search report

09/05/2012

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/NL2012/050213

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2030480	A5	13-11-1970	NONE

US 2010310319	A1	09-12-2010	AT 535746 T 15-12-2011
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