(12) **PATENT**

(19) NO (11) **340255** (13) **B1**

NORWAY (51) Int Cl.
E21B 43/013 (2006.01)
F16L 1/26 (2006.01)

Norwegian Industrial Property Office

(21)	Application nr.	20150285	(86)	International Filing Date and Application Number
(22)	Date of Filing	2015.03.03	(85)	Date of Entry into National Phase
(24)	Date of Effect	2015.03.03	(30)	Priority
(41)	Publicly Available	2016.09.05		
(45)	Granted	2017.03.27		
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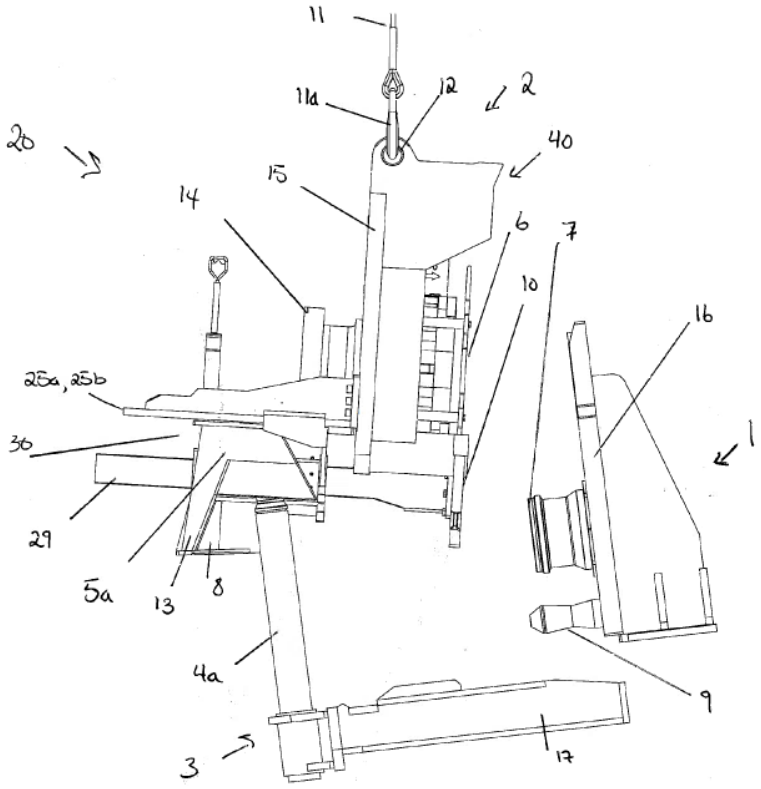
(54) Title **CONNECTION SYSTEM FOR SUBSEA PIPELINES**

(56) References Cited:
US 8794336 B2
US 2007/0269270 A1

(57) Abstract

The invention relates to a device for landing or retrieving a pipeline end on the seabed, the device comprising an outboard connecting part (2) being adapted to connect with the pipeline end and lowered from the surface towards a landing structure (3) on the seabed or alternatively lifted from the landing structure (3) on the seabed towards the sea surface. The invention is distinctive in that the outboard connecting part (2) comprising a pair of guide funnels (5a, 5b) adapted to engage with a pair of corresponding guideposts (4a, 4b) arranged on the landing structure (3), at least one fin (8) is attached to the outboard connecting part (2) and is adapted to bear against the landing structure (3), said pair of guide funnels (5a, 5b) are adapted to be in contact with the corresponding pair of guideposts (4a, 4b) when the outboard connecting part (2) is resting on the landing structure (3).



CONNECTION SYSTEM FOR SUBSEA PIPELINES

The present invention relates to a connector for use on the seabed together with a seabed fixed guidepost part, which parts together make up a landing structure for assistance during lowering of a component from the surface of the water from a surface structure to obtain a focused landing of said component at a predetermined location or the retrieval of the connector from the seabed towards the sea surface. The releasable connector includes a downwardly facing fin (in the position of use) designed for abutting the seabed fixed guidepost part and prevent the connector from tipping when resting on the landing structure .

TECHNICAL BACKGROUND OF THE INVENTION

Piping is often arranged on subsea structures, for example manifold and valve structures, which are deployed on the seabed. The piping comprise one or more pipes that terminate in open pipe subs, or porches, forming a connecting point. Each connecting point includes a stationary connecting part. Stationary in this context means relative to the subsea structure. The connecting point is later used for connection to an external pipe or subs.

There exist two principles for the connecting devices, either vertical or horizontal. For a horizontal connecting device, the connecting point projects horizontally out from the structure. In the North Sea, this solution has almost market control. Other places, like the Gulf of Mexico for example, the vertical solution is the most common one.

There are in principle three (or actually two) different forms for external connections to a structure:

-Direct connection between two structures: Here, a rigid pipe having a movable connecting part at each end will normally be used. This is usually termed a jumper. The jumper is manufactured based on measuring the relative position of the two connecting points.

-Connection between the end of a pipeline (rigid pipe) and a structure: It is almost impossible (at least very difficult) to connect a rigid pipeline directly to a structure preinstalled on the seabed. Thus, an intermediate piece of pipe, frequently termed a “spool”, is provided between the pipeline and the structure. In order to

connect the spool to the pipeline, the pipeline will be welded directly to a small structure including a connecting point. A spool is in principle like the jumper described above.

-Direct connection of a flexible pipeline or umbilical to a structure: In some cases it is chosen to use flexible pipes instead of rigid steel pipes. Such pipes can be compared to a big garden hose. Then it is not necessary with a spool or jumper between the end of the pipe and the structure. It is then not necessary to make precise measurements of the position on the connecting point on the structure. The present invention is related to the last principle.

Many solutions for accomplishing the direct connection of a flexible pipeline or umbilical to a structure are known.

Publication US 8794336 discloses a tool for connecting an end of a first pipeline to an end of a second pipeline supported by a subsea structure. The subsea structure having at least two guide elements. The tool comprising guide elements adapted to interface with the guide elements in order to position the first pipeline end in close relation to the second pipeline supported by a subsea structure. The publication do not disclose a fin that is arranged between the pair of guide funnels on the tool so that the tool with the first pipeline end is adapted to rest on the landing structure before it is connected to the second pipeline.

Publication US20070269270 discloses a pipeline termination skid to be mounted to a pipeline end section to support a pipeline hub during the connection of the pipeline hub to a corresponding spool piece hub. The pipeline end section is mounted to the pipeline termination skid subsea by lowering the pipeline end section into a seat of one or several holding devices of the pipeline termination skid and thereafter displacing the pipeline termination skid along the pipeline end section so that the respective seat is brought into engagement with an alignment element secured about the pipeline end section to fix the pipeline end to the termination skid. The publication do not however disclose a fin arranged on the pipeline end section so that the pipeline end section can rest on the seabed before connected to the pipeline termination skid.

The publication WO2008063080 relates to connector means with a fixed connector part with a guidepost arranged at the seabed and a movable connector part for lowering a flexible pipeline to the connector part in the seabed. The movable connector having one funnel adapted to engage with the guidepost of the fixed structure when lowered into the seabed. The movable connector will be exposed to heave motion induced by the vessel. This will make it more difficult to enter the guidepost especially in deep waters where it is not possible to use guide wire for better control.

Publication WO2011043671 shows a similar connection device comprising a fixed connecting part, a movable connecting part and a landing structure. In this publication, there is no guiding post or funnel to position the movable connecting part in relation to the landing structure and the fixed connecting part.

Pipelines of steel are rigid and require that the connecting parts are positioned near each other approximately in a range between +/-100mm. Flexible pipeline have more flexibility and could deal with a range of 10-20 m or more between the connecting parts. This means that the connecting parts do not need an exact positioning when they are lowered to the seabed.

In previous solutions, the inboard connecting part have to be installed on the seabed together with the landing structure before the outboard connecting part attached to the pipeline end is lowered to the seabed and landed on the seabed.

OBJECTS OF THE INVENTION

It is an objective of the present invention to provide a system that allows for landing of the outboard connecting part which is attached to the flexible pipeline end prior to landing of the inboard connecting part which is attached to subsea

installation or similar at the seabed. Several pipeline ends can therefore be lowered to the seabed prior to the connection to the subsea installation. The installation is prevented from tilting when it is resting on the landing structure at the seabed.

It is another objective of the present invention to provide an installation that makes it possible to guide and land a flexible connection in a wide range of installation angles. The seabed are some places uneven. The landing structure will follow the uneven surface. This resulting in that the guidepost will have different angles on the seabed.

It is yet another objective of the present invention to provide an installation that has a simple, robust construction.

It is yet another objective of the present invention to provide an installation where the maintenance/service activities are considerably reduced.

It is yet another objective of the present invention to provide an installation where the parts deployed at the seabed are situated in a plane tilted relative to the plane of the seabed. The purpose of this is to reduce loads during and after connection of the connecting parts.

It is also an objective of the present invention to provide an installation with two guideposts in order to guide the parts into connection with each other. The guideposts having different heights to make the connection with the funnels easier.

It is yet another objective of the present invention to provide an installation where the height of the prism-shaped parts of the funnels are shorter than the traditional funnels to make the mating with the guidepost easier.

SUMMARY OF THE INVENTION

The invention relates to a device for landing or retrieving a pipeline end on the seabed, the device comprising an outboard connecting part being adapted to

connect with the pipeline end and lowered from the surface towards a landing structure on the seabed or alternatively lifted from the landing structure on the seabed towards the sea surface. The outboard connecting part further comprising a pair of guide funnels adapted to engage with a pair of corresponding guideposts arranged on the landing structure, The invention is distinctive in that the outboard connecting part comprising at least one fin arranged between the pair of guide funnels, said at least one fin is adapted to bear against the landing structure and said pair of guide funnels are adapted to bear against the corresponding pair of guide posts when the outboard connecting part is resting on the landing structure.

This provides a device where the pipeline and especially a flexible pipeline can be deployed at the seabed before the inboard connecting part.

In yet another preferable embodiment of the invention each of the the funnels is shaped as a frustum of a pyramid or a cone with a first wide end and a second, narrow end .

In another preferable embodiment of the invention each of the funnels have extension plate arranged in connection with the funnel at the second, narrow end of said funnel.

In another preferable embodiment of the invention the height of the extension plate is less than 3 x diameter of said guide post. This provides an easier mating of the guideposts and the funnels.

In another preferred embodiment said pair of guide funnels are adapted to bear against the extension plate of the corresponding pair of guideposts when the outboard connecting part is resting on the landing structure.

In yet another preferable embodiment of the invention the connecting device comprising a funnel frame and a connecting frame, said funnel frame is slidably connected to the connecting frame. The connection frame is adapted to be

moved towards the inboard connecting part while the funnel frame are at rest on the landing structure.

In another preferable embodiment of the invention a center guide is extending from the connecting frame through a channel in the funnel frame.

In another preferred embodiment of the invention the center guide (29) adapted to bend in the free end. This provides a dampening of the outboard connection when the outboard connection lands on the landing structure.

In yet another preferable embodiment of the invention a pair of guide rails are extending from the connecting frame through rail guides attached to the funnel frame.

In another embodiment of the invention there is a clearance between the guide rails and the rail guides. The clearance provides a movement between the funnel frame and the connection frame and a boundary for the movement.

In another embodiment of the invention the at least one guidepost is arranged perpendicular in relation to a landing frame of the landing structure , said landing frame is configured to be inclined relative to the seabed, when said landing structure is resting on the seabed.

In another preferred embodiment of the invention there ere are arranged at least two guideposts spaced apart on the landing frame, said distance between the guidepost equals the center distance between the funnels arranged on the

outboard connecting part.

In yet another preferred embodiment according to the invention the guideposts have different lengths.

BRIEF DESCRIPTION OF THE DRAWINGS

Having described the main features of the invention above, a more detailed and non-limiting description of an exemplary embodiment will be given in the following with reference to the drawings.

Figure 1 shows a connector device according to the present invention, viewed schematically from the side.

Figure 2 shows a detail view of the funnel frame, viewed from below.

Figure 3 shows a detail view of the funnels and fin of the outboard connecting part, viewed from the below.

Figure 4a shows a detail view of the funnel with center and side rails, seen from behind.

Figure 4b shows a detail view of the outboard connecting part in an initial mating position with the landing structure.

Figure 4c shows a detail view of the outboard connecting part in resting position on the landing structure.

Figure 5 shows the outboard connecting part and the guidepost attached to the landing structure according to the present invention, viewed from above.

Figure 6 shows a sectional view of the outboard connecting part according to the invention in an initial mating position with the guideposts on the landing structure, viewed from the side.

Figure 7 shows a sectional view of the outboard connecting part according to the invention in a resting position on the landing structure, viewed from the side. The fin is abutting an edge on the landing structure.

Figure 8- Figure 10 shows the different steps of the lowering of the outboard connecting parts together with the pipeline end towards the resting position on the landing structure arranged on the seabed.

Figure 11 shows a principle sketch of the lowering of the outboard connecting part with a flexible pipeline attached.

DETAILED DESCRIPTION OF THE INVENTION

Other and further objects, features and advantages will appear from the following description of preferred embodiments of the invention, which is given for the purpose of the description, and given in context with the appended drawings where:

Figure 1 shows a complete connecting device 20, assembled by a first connecting part 1, hereinafter called inboard connecting part 1, a second connecting part 2, hereinafter called outboard connecting part 2 and a landing structure 3.

The inboard connection part is shown in figure 1 as an illustration of the principle of use. It is according to the invention not necessary that the inboard connecting part 1 has been installed at the seabed before the outboard connecting part 2 is lowered to the landing structure 3 at the seabed. The outboard connection part 2 is independent of the inboard connection part 1 and could be arranged on the landing structure 3 at the seabed prior to the inboard connecting part 1 is installed at the seabed.

The connecting device 20 is developed to perform mating and connection of a first pipeline 21 (shown in Figure 8) and a second pipeline or other subsea arrangements arranged on the seabed (not shown). The figure shows the connecting device 20 in a position where the outboard connecting part 2 is lowered down to the inboard connecting part 1 at the seabed, viewed from the side.

The inboard connecting part 1 is adapted to be secured to the second pipeline (not shown) or a subsea structure (not shown), such as a manifold structure or an x-tree structure etc. through a connection point. The inboard connecting part 1 and the outboard connection part 2 are connecting the first pipeline 21 and the second pipeline or subsea structure together through inboard 7 and outboard

hubs 14. The inboard connecting part 1 is stationary relative to the subsea structure.

The landing structure 3 is located adjacent to the inboard connecting part 1 or in connection with the inboard connecting part 1. The landing structure 3 could also be installed at the seabed before the inboard connecting part 1. The landing structure 3 act as a support for the outboard connecting part 2 when it is deployed at the seabed.

In figure 3 there is shown two guideposts 4a, 4b arranged on the end of the landing structure 3 facing away from the inboard connecting part 1. The guideposts 4a, 4b are spaced apart on a robust and rigid frame structure 17. The guideposts 4a, 4b are extending upwards substantially perpendicular to the frame structure 3.

The outboard connecting part 2 is adapted to be connected to a pipeline end 21a (figure 11) of the first pipeline 21 at the sea surface, on for instance a vessel and the outboard connecting part 2, is then lowered to the seabed to the landing structure 3.

The outboard connecting part 2 comprises a connecting frame 40 and a funnel frame 30. These parts are slidably connected to each other.

The connecting frame 40 of the outboard connecting part 2 has a vertically aligned reaction plate 15 with an opening where an outboard hub 14 is attached. The pipeline 21 is adapted to be connected to the reaction plate 15 via the outboard hub 14 and the reaction plate 15 distributes the forces between the structure, i.e. pipeline or subsea structure and the outboard hub 14.

A clamp connector 6 is arranged at the opposite side of the reaction plate 15 at the side facing the inboard connecting part 1. The clamp connector 6 is adapted to clamp the outboard hub 14 with the first pipeline 21 which are attached to the outboard connecting part 2 together with an inboard hub 7 arranged on the inboard connecting part 1. The inboard hub 7 of the inboard connecting part 1 is

arranged on a vertically aligned reaction plate 16 and is adapted to connect at the opposite end to a pipeline or a connection point of a subsea structure arranged on the seabed (not shown).

At the lower part of the inboard connecting part 1, there are arranged alignment rods 9. The alignment rods 9 being able to receive alignment cylinders 10 arranged on the outboard connecting part 2 when the outboard connecting part 2 is moved towards the inboard connecting part 1 after the outboard connecting 2 part has landed on the landing structure 3.

The inboard connecting part 1 and the landing structure 3 are positioned on the seabed with a slight inclination relative to the seabed in the Figures. In Figure 10 this inclination between the landing structure and the seabed is shown in greater detail. The pipeline attached to the outboard connecting part has a minimum break in the pipeline the more the downwardly inclination is. The load acting from the pipeline acting on the outboard connecting part 2 is reduced because more of the pipeline is arranged on the seabed.
It is also an embodiment of the invention that the landing structure 3 are arranged in substantially the same horizontal plane as the seabed but in this embodiment more of the pipeline is arranged above the seabed and the load of the pipeline is thus increased compared to the embodiment with the inclined landing structure 3.

The reaction plate 15 and the guideposts 4a, 4b are substantially perpendicular to this inclined plane. This makes it easier for the funnels 5a, 5b to engage with the guidepost 4a, 4b when the outboard connecting part 2 is mating with the guidepost 4a, 4b.

The outboard connecting part 2 is suspended from wires 11 attached to hooks 11a. The hooks 11a are adapted to engage in holes or eyes 12 in the top part of

the connecting frame 40 when the outboard connecting part 2 is lowered down to the seabed towards the guideposts 4a, 4b.

The outboard connecting part 2, comprising a connecting frame 40 and a funnel frame 30. The funnel frame having funnels 5a, 5b.

The funnel frame 30 is shown in detail in Figure 2 where the funnel frame 30 is viewed from below.

As shown in figure 2, there are arranged two funnels 5a, 5b juxtaposed or beside each other in the funnel frame 30.
Each of the funnels 5a, 5b has the shape of a frustum of a pyramid with a first wide end facing downwardly and a second, narrow end, facing upwardly.

At least one of the four sides 50a, 50b is arranged sloping from the wide end facing the seabed towards the narrow end 52 having a smaller rectangular or square shape 51a, 51b.
At the narrow side of the funnels 5a, 5b there is a small prism-shaped extension plate 51a, 51b.

The guide funnels could optionally also have a shape as a cone with a wide end and a narrow end. In this embodiment the extension plate 51a, 51b on the narrow end having a cylindrical shape.

The extension plate is indicated by reference mark 51a, 51b in figure 2 and are here shaped as a rectangular extension or a cylindrical extension with a small height around the narrow rectangular or cylindrical opening at the narrow end 52a, 52b of the funnels 5a, 5b. All sides of the rectangular or cylindrical extension plate is of equal height from the funnel 5a, 5b. The height of the extension plate 51a, 51 is preferably less than 3 x diameter of the guidepost 4a, 4b and makes it easier for the guidepost 4a, 4b to mate with the funnels 5a, 5b when the outboard

connecting part 2 is lowered down to the landing structure 3, especially when the outboard connecting part 2 is engaging the funnels (5a, 5b) at different angles. The height of the extension plate 51a, 51b could be as small as practically possible.

The Figure 2 also shows a fin 8 situated between the guide funnels 5a, 5b. This fin 8 is extending downwardly from the funnel frame 30 and is adapted to abut an edge 18 in the landing structure 3 when the outboard connecting part 2 s brought down on the landing structure 3. This will be further described in Figure 7.

A perforated plate 13 is extending downward from each of the funnels 5a, 5b at the sides 50a, 50b of the funnels 5a, 5b arranged on the funnel frame 30 side of the outboard connecting part 2. A t-shaped beam 31 could be arranged beneath and in contact with the perforated plate 13 and the fin 8.

The fin 8 is adapted to stop forward motion or backward tilting of the outboard connecting part 2 when it is resting on the landing structure 3. This will be further described below.

The funnel frame 30 further comprises a support plate 35 arranged on the opposite side of the funnels relative to the perforated plate 13. The support plate 35 having an opening 36 and a channel 37 (Figure 4a) arranged between the guide funnels 5a, 5b, adapted to receive a center guide 29 (shown in Figure 1).

The center guide 29 is connected to the connecting part 40 and slidably connected to the funnel frame 30 through the opening 36 and channel 37.

Figure 3 shows the initial position where the outboard connecting part 2 is lowered on the landing structure 3. The Figure shows the connecting frame 40 and the funnel frame 30 in greater detail.

The funnels 5a, 5b are attached to or an integrated part of the funnel frame 30 are engaging the top of the respective guideposts 4a, 4b attached to the landing structure 3.
The fin 8 is situated below the funnels 5a, 5b in a position between the funnels 5a, 5b. The fin 8 is attached to the funnel frame 30.
The fin 8 could be bolted to the funnel, welded or attached in other ways to the funnel frame 30. The fin 8 could also have other arrangement or positions on the funnel frame 30 suitable for supporting the connecting part 2 on the landing structure 3.

The landing structure has an edge 18 (see figures 3, 4b, 4c, 6, 7) arranged between the guideposts 4a, 4b. The fin 8 and the edge 18 is substantially aligned in the vertically direction so that the fin 8 is abutting the edge 18 when the outboard connecting part 2 is resting on the landing structure 3. This is shown in Figure 6.

The funnel frame 30 is adapted to move in the substantially horizontal direction relative to the connecting frame 40 in a sliding connection.
As described above one of the sliding connections between the funnel frame 30 and the connecting frame 40, is the center guide 29, which is extending through a channel 37 attached to the funnel frame 30.

In addition to this, the connecting frame 40 has a pair of side rails 25a, 25b (see figures 1, 4a extending substantially horizontally from the connecting frame 40

parallel to the guide rail 29. The side rails 25a, 25b and the center guide 29 are extending in planes perpendicular to the outboard reaction plate 15.

The side rails 25a, 25b and the center guide 29 are extending from different planes as shown in particular in Figure 4. The center guide 29 is situated below the side rails 25a, 25b.

The funnel frame 30 has corresponding rail guides 32a, 32b (see figures 1, 5.) enclosing the side rail 25a, 25b. This provides a second and third sliding connection between the funnel frame 30 and the connecting frame 40.

The side rails 25a, 25b and the connection with the rail guide 32a, 32b are shown in detail in Figure 4. The center guide 29 and channel 37 are also shown in this Figure. The funnel frame 30 is in this Figure viewed from behind.

The center guide 29 is attached to the connecting frame 40. The center guide 29 is bolted to the connecting frame 40 and is extending through the channel 37, which has a similar shape as the center guide 29. The center guide 29 has a free end at the opposite side. The center guide 29 could act as a resilient member in the free end and is adapted to bend 10 mm in each direction. This is advantageous when the outboard connecting part 2 are mating with the landing structure 3 to mitigate the connection.

The funnel frame 30 is slidably connected to the center guide 29 and the connecting frame 40.

When the outboard connecting part 2 is lowered down to the landing structure 3, the funnel frame 30 is arranged near the free end of the center guide 29. This gives a little flexibility between the funnel frame 30 and the connecting frame 40, because it is possible for the center guide 29 to bend slightly in either direction. There is arranged spacers 38 within the channel 37. These are preferably made of plastic and are situated in the opening between the center guide 29 and the channel to prevent the center guide 29 from touching the sides of the channel and damage the center guide 29 or the channel 37. The center guide 29 will as

described above also function as a damper when the funnels 5a, 5b of the outboard connecting part 2 are engaging the guidepost 4a, 4b and especially when the outboard connecting part 2 is landed on the landing structure 3 since the guide rail 32a, 32b is adapted to bend approximately 10 mm to the sides as well as up and down.

There is also a gap 39 between the center guide 29 and the reaction plate 15 to reduce the impact on the reaction plate 15 when the outboard connecting part 2 is landing on the landing structure 3. This is shown in Figure 4b in the initial mating position and in 4c in the resting position of the outboard connecting part 2.

The figures also show at least one resting plate 18b arranged on the landing structure 3, which is adapted to receive the support plate 35. The resting plate 18b is inclined downwards from an end plate 18c integrated on the landing structure 3. The end plate 18c is arranged as an extension of the edge on both sides of the edge 18a, connecting the guidepost 4a, 4b together. The at least one resting plate 18b gives an additional support to the outboard connecting plate 2 in the resting position, to prevent the outboard connecting part 2 from tilting. This resting plate 18b arranged on the end plate, or alternatively a multiple of plates, are optional embodiments of the invention.

The side rails 25a, 25b, which are situated in a plane above the center guide 29, are shown in Figure 4a.

The side rails 25a, 25b are extending from the outboard reaction plate 15 through rail guide 32a, 32b in the upper part of the funnel frame 30, as shown in Figure 4a. There is a clearance between the side rails 25a, 25b and the rail guide 32a, 32b to allow some movement between the funnel frame 30 and the connecting frame 40. The clearance between the side rail 25a, 25b and the rail guide 32a,

32b could be about 10 mm which are the same as the allowed movement of center guide 29.
The guide rails 32a, 32b acts as an end stopper for the movement of the center guide 29.
There could also be a small clearance between the channel 37 and the center guide 29.

Figure 5 shows the outboard connecting part 2 from figure 1, topside view.
In this figure, the side rails 25a, 25b have slots 25a' 25b' as an optional embodiment. A protrusion 33a connected to the funnel frame 30 is arranged in the slot 25a' to guide the direction of movement of the between the funnel frame 30 and connecting frame 40. The figure shows one protrusion 33a, but there could optionally be more than one or even no protrusions 33a.

Figure 6 shows the position and the shape of the fin 8 and the edge 18 in the initial mating position of the outboard connecting part 2, viewed from the side. The fin 8 and the edge 18a are shown in shaded area..

Figure 7 shows the outboard connecting part 2 resting on the landing structure 3. In this position, there are three points 26, 27a, 27b of contact between the outboard connecting part 2 and the landing structure 3. These points 26, 27a, 27b of contact makes it possible for the outboard connecting part 2 to rest on the landing structure 3 before connecting to the inboard connecting part 1

A first point 26 of contact between the fin 8 and the edge 18a, a second point 27a of contact arranged between the guidepost 4a and the funnel 5a and a third point of contact arranged between the guidepost 4b and the funnel 5b. The point of

contact is at the extension plate of the funnel 51a, 51b (shown in Figure 2) .

The fin 8 could have a rounded surface 8a at the corner facing the edge 18, or a shape as a shortened edge with sides 8a, 8b which meets in a tip 8c.

This tip 8c is abutting the edge 18 in the resting position of the outboard connecting part 2 and prevents the outboard connecting part 2 from tipping. Others shapes of the fin is also possible embodiments of the invention. There is no mechanical coupling between the landing structure 3 and the outboard connecting part 2 in the resting position. The fin could also have other shapes suitable for resting on the landing structure 3.

The following figures 8-10 shows the lowering of the of the outboard connecting part 2 to the landing structure and the connection of the outboard connecting part 2 to the inboard connecting part 1.

The figures 8-10 show the inboard connection part 1 arranged at the seabed before lowering of the outboard connection part 2 but this is not mandatory. The inboard connection part 1 can be deployed at the seabed after the deployment of the outboard connection part 2.

Figure 8 shows the outboard connecting part 2 in an initial mating position above the landing structure 3. The guideposts 4 are substantially aligned perpendicularly to the frame structure 17 below the funnels 5 and are adapted to engage with the funnels 5a, 5b.

When the outboard connecting part 2 is lowered down to the landing structure 3 by the wires 11, there could be a slight movement or rotation of the outboard connecting part 2 due to movement of the vessel i.e. from which the outboard connecting part 2 is lowered. When the first end of the pipeline is lowered down this angle could be controlled by the ratio between the lowering of the outboard connecting part 2 and lowering of the pipeline. The speed of the lowering of the wire could and the speed of the lowering of the pipeline could be controlled

independently to have different inclination of the outboard connecting part 2 relative the seabed.

The two guideposts 4a, 4b are arranged substantially perpendicular to the landing structure 3. The optimal mating position is when the outboard connecting part 2 are lowered with the same inclination relative the seabed as the landing structure 3.

The guidepost 4a and the guidepost 4b could be of equal length or there could be a difference in length between the guidepost 4a and guidepost 4b. These being optionally embodiments of the invention.
A difference in the length between the guidepost 4a and guidepost 4b makes it easier for the outboard connecting part 2 to engage with the
The guidepost 4a is longer than the guidepost 4b (not shown). There could be a difference in length between the guidepost 4a and guidepost 4b. This makes it easier for the outboard connecting part 2 to position the outboard connecting part 2 and engage with the guidepost 4a, 4b on the landing structure 3. The short prism-shaped or cylindrical extensions plates 51a, 51b from the narrow side of the frustum make it also easier for the guidepost 4a, 4b and the funnels 5a, 5b to mate.
The guidepost 4a, 4b could optionally have equal length, this being an embodiment of the invention.

The outboard connecting part 2 is guided further down on the guidepost 4a, 4b until it rests on the landing structure 3. In this resting position, there is a gap 39 or distance between the inboard hub 7 at the inboard connecting part 1 and the clamping connector 6 at the outboard connecting part 2. This is illustrated in Figure 9.

A stroke tool (not shown) is adapted to be arranged with one end in a stroke tool slot 23 arranged in the reaction plate 16 of the inboard connecting part 1. The other end is arranged in a similar slot 24 in the reaction plate 15 on the connection frame 40 of the outboard connecting part 2. When the stroke tool is activated, the connection frame 40 of the outboard connecting part 2 and the

inboard connecting part 1 will be pulled together. The funnel frame 30 is held in a steady position because of the engagement between the guideposts 4a, 4b and funnels 5a, 5b. The slidably connection between the funnel frame 30 and the connection frame 40 allows the connection frame 40 with the pipeline 21 to move away from the funnel frame 30. The connection frame 40 will move towards the inboard hub1.

Figure 10 shows the inboard hub 7 of the inboard connecting part 1 and the outboard hub 14 of the outboard connecting part 2 connected to each other through the clamp connector 6.

Figure 11 shows schematically the lowering of the outboard connecting part 2 to the seabed. The Figure shows that the first end 21a of the attached pipeline 21 that is lowered to the seabed. The other end of the pipeline is arranged on the vessel, platform or similar device at the water surface (not shown). The outboard connecting part 2 will therefore only carry a part of the weight of the pipeline 21 when the connecting part 1 is lowered to the seabed.

The present invention has been described with reference to a preferred embodiment and some drawings for the sake of understanding only and it should be clear to persons skilled in the art that the present invention includes all legitimate modifications within the ambit of what has been described hereinbefore and claimed in the appended claims.

CLAIMS

1.

A device for landing or retrieving a pipeline end on the seabed, the device comprising an outboard connecting part (2) being adapted to connect with the pipeline end, and to be lowered from the surface towards a landing structure (3) on the seabed or alternatively lifted from the landing structure (3) on the seabed towards the sea surface the outboard connecting part (2) comprising a pair of guide funnels (5a, 5b) adapted to engage with a pair of corresponding guideposts (4a, 4b) arranged on the landing structure (3), c h a r a c t e r i s e d i n that the outboard connecting part (2) comprising at least one fin (8) arranged between the pair of guide funnels (5a, 5b) , said at least one fin (8) is adapted to bear against the landing structure (3) and said pair of guide funnels (5a, 5b) are adapted to bear against the corresponding pair of guideposts (4a, 4b) when the outboard connecting part (2) is resting on the landing structure (3).

2.

A device for landing or retrieval of the pipeline end according to claims 1, wherein each of the funnels (5a; 5b) is shaped as a frustum of a pyramid or a cone with a first wide end and a second, narrow end.

3.

A device for landing or retrieval of the pipeline end according to any one of the claims 1-2, wherein each of the guide funnels (5a, 5b) have extension plate (51a, 51b) arranged in connection with the guide funnel (5a, 5b) at the second, narrow end (52a, 52b) of said guide funnel (5a, 5b).

4.

A device for landing or retrieval of the pipeline end according to claim 3, wherein the height of the extension plate (51a, 51b) is less than 3 x diameter of said guide post (4a, 4b).

5.

A device for landing or retrieval of the pipeline end according to claim 3 or 4,

wherein said extension plate (51a, 51b) of the guide funnels (5a, 5b) are adapted to bear against the of the corresponding pair of guidepost (4a, 4b) when the outboard connecting part (2) is resting on the landing structure (3).

6.

A device for landing or retrieval of the pipeline end according to any one of claim 1-5, wherein the connecting device comprising a funnel frame (30) and a connecting frame (40), said funnel frame (30) is slidably connected to the connecting frame (40).

7.

A device for landing or retrieval of the pipeline end according to claim 6, wherein a center guide (29) is extending from the connecting frame (40) through a channel (37) in the funnel frame (30).

8.

A device for landing or retrieval of the pipeline end according to claim 7, wherein the center guide (29) having a free end .

9.

A device for landing or retrieval of the pipeline end according to any one of claims 6-8, wherein a pair of side rails (25a, 25b) are extending from the connecting frame (40) through rail guides 32 attached to the funnel frame (30).

10.

A device for landing or retrieval of the pipeline end according to claim 9, wherein there is a clearance between the side rails (25a, 25b) and the rail guides (32a, 32b).

11.

A device for landing or retrieval of the pipeline end according to any one of claims 1-3, the at least one guidepost (4a, 4b) is arranged perpendicular in relation to a landing frame (17) of the landing structure (3), said landing frame (17) is

configured to be inclined relative to the seabed, when said landing structure (3) is resting on the seabed.

12.

A device for landing or retrieval of the pipeline end according to claim 4, wherein there are arranged at least two guideposts (4a, 4b) spaced apart on the landing frame (3), said distance between the guidepost (4a, 4b) equals the center distance between the funnels (5a, 5b) arranged on the outboard connecting part (2).

13.

A device for landing or retrieval of the pipeline end according to claim 5, wherein the guideposts (4a, 4b) have different lengths.

K r a v

1.

En innretning for nedsenkning og opphenting av en rørende på havbunnen, innretningen omfatter en utenbords koblingsdel (2) er innrettet til å kobles med rørenden, og sammen med denne senkes ned fra overflaten mot en mottakerstruktur (3) på havbunnen eller alternativt bli løftet fra mottakerstrukturen (3) på havbunnen mot havoverflaten, utenbordskoblingsdelen (2) omfatter et par føringstrakter(5a, 5b) innrettet til å komme i inngrep med et par korresponderende føringsstøtter (4a, 4b) anordnet på mottakerstrukturen (3) k a r - a k t e r i s e r t v e d at utenbordskoblingsdelen (2) omfatter minst en finne (8) anordnet mellom paret av føringstrakter (5a, 5b), nevnte minste ene finne (8) er tilpasset til å ligge an mot mottakerstrukturen (3) og nevnte par av føringstrakter (5a, 5b) er innrettet til å ligge an om de korresponderende paret av føringsstøtter (4a, 4b) når utenbordskoblingsdelen (2) hviler mot mottaker strukturen (3).

2.

En innretning for nedsenkning og opphenting av rørenden ifølge krav 1, hvori hver av føringstraktene (5a, 5b) er formet som en avkortet kjegle eller en konus med en første vid ende og en andre, innsnevret ende.

3.

En innretning for nedsenkning og opphenting av rørenden ifølge et av kravene 1-2, hvori hvert av føringstraktene (5a, 5b) har en forlengelsesplate (51a, 51b) koblet til føringstraktens (5a, 5b) andre, smale ende (52a, 52b).

4.

En innretning for nedsenkning og opphenting av rørenden ifølge kravet 4, hvori høyden på forlengelsesplaten (51a, 51b) er mindre enn 3 x diameter til nevnte føringsstøtte. (4a, 4b).

5.

En innretning for nedsenkning og opphenting av rørenden ifølge krav 5, hvori forlengelsesplaten (51a, 51b) til nevnte par av føringstrakter (5a, 5b) er innrettet til å ligge an

mot de korresponderende par av føringsstøtter (4a, 4b) når utenbords koblingsdelen (2) ligger an mot mottakerstrukturen (3).

6.

En innretning for nedsenkning eller opphenting av rørenden ifølge et av kravene 1-5, hvori koblingsdelen omfatter en ramme for føringsdelen (30) og en koblingsramme(40), føringsdel rammen (30) er glidbar koblet til koblingsrammen (40).

7.

En innretning for nedsenking eller opphenting av rørenden ifølge krav 6, hvori en senterføring (29) strekker seg fra koblingsrammen (40) gjennom en kanal (37) i førings delrammen (30).

8.

En innretning for nedsenking eller opphenting av rørenden ifølge krav 7, hvori senter føringen (29) har en fri ende.

9.

En innretning for nedsenking eller opphenting av rørenden ifølge et hvilket som helst av kravene 6-8, hvori et par av side skinner (25a, 125b) strekker seg fra koblingsrammen (40) gjennom skinneføringer (32) som er festet til føringsdel rammen (30).

10.

En innretning for nedsenking eller opphenting av rørenden ifølge krav 9, hvori det er en klaring mellom side skinnene (25a, 25b) og skinneføringene (32a, 32b).

11.

En innretning for nedsenking eller opphenting av en rørende ifølge et av kravene 1-3, den minst ene føringsstøtten (4a, 4b) er anordnet vinkelrett i forhold til en mottaker ramme (17) på mottakerstrukturen (3), nevnte mottaker ramme (17) er orientert vinkelrett i forhold til havbunnen, når nevnte mottaker struktur hviler på havbunnen.

12.

En innretning for nedsenkning eller opphenting av rørenden ifølge krav 4, hvori det på mottakerstrukturen (3) er det anordnet minst to føringsstøtter (4a, 4b) med en avstand fra

hverandre, nevnte avstand mellom føringsstøttene (4a, 4b) er lik senter avstanden mellom føringstraktene (5a 5b) som er anordnet på utenbordskoblinsdelen (2).

13

En innretning for nedsenkning eller opphenting av rørenden ifølge krav 5, hvori føringsstøttene (4a, 4b) her forskjellig lengde.

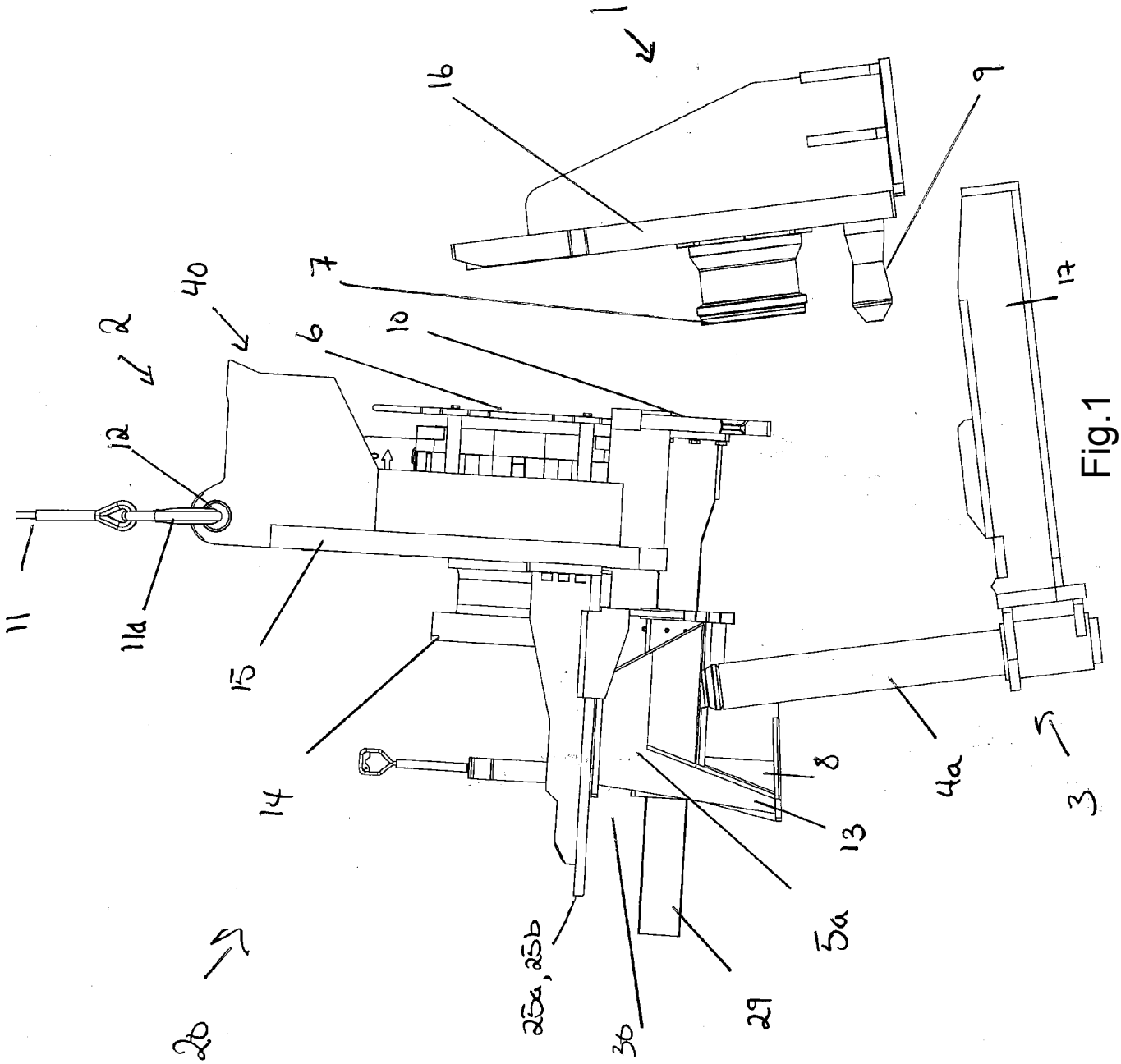


Fig.1

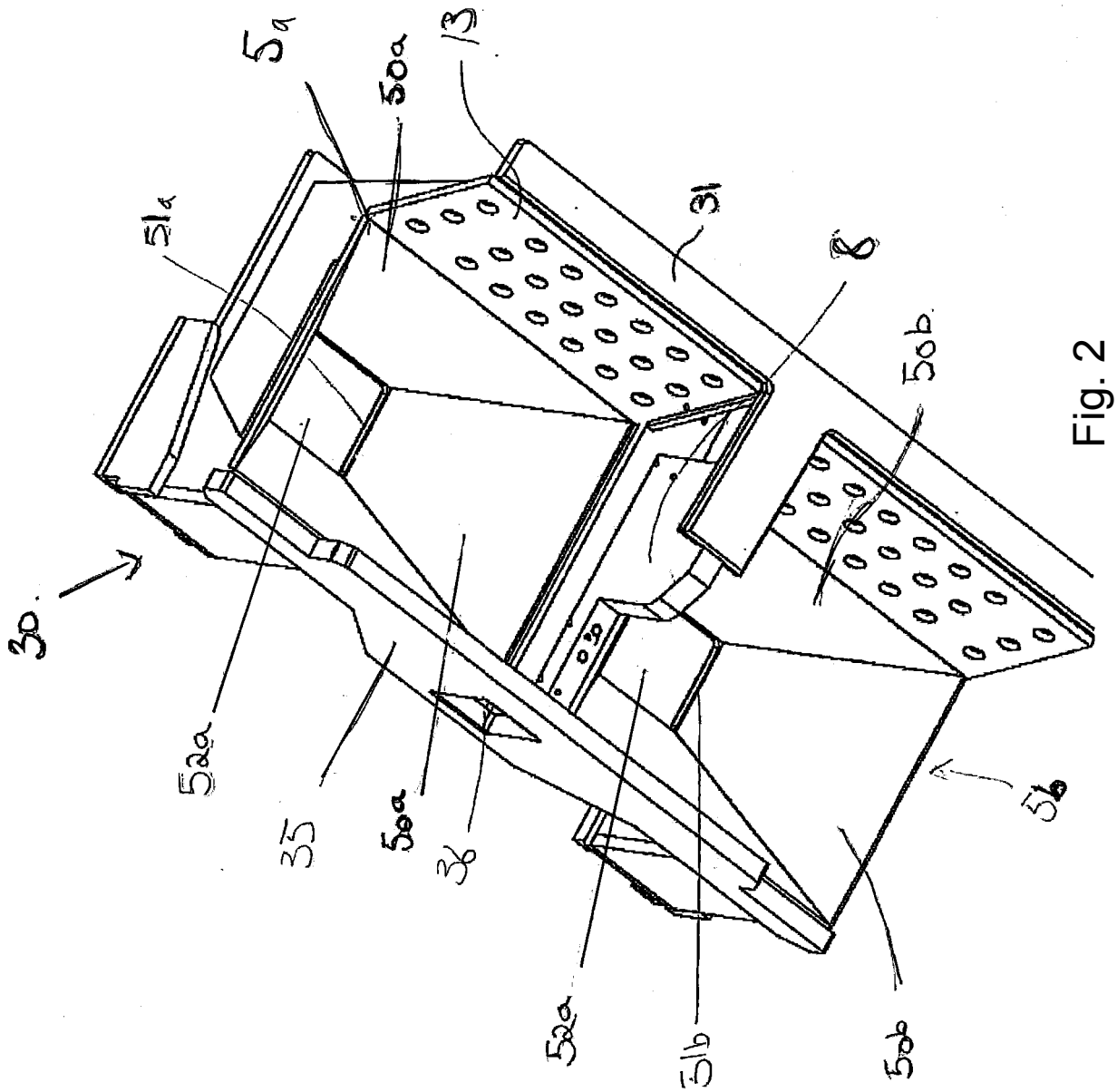


Fig. 2

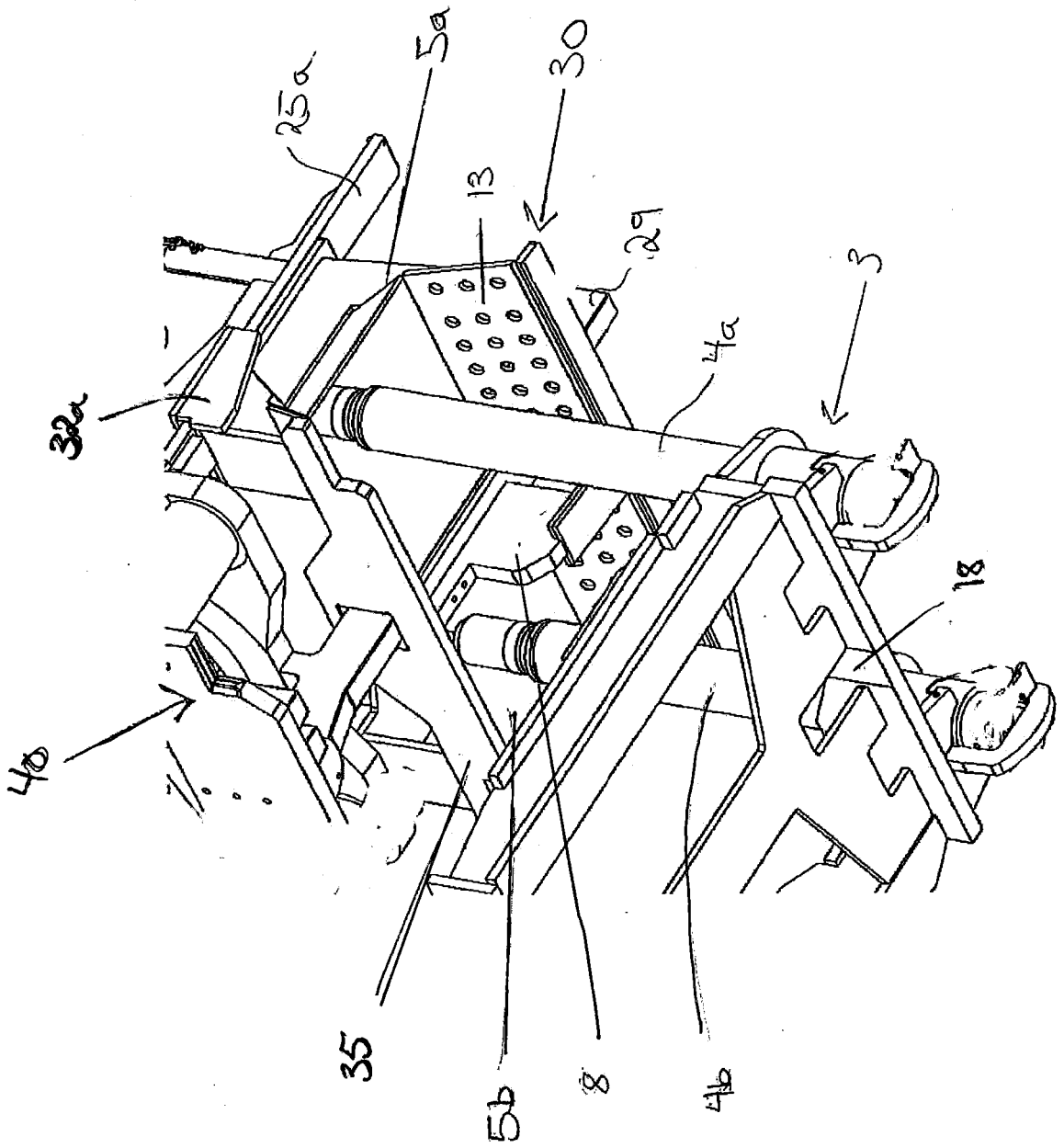


Fig. 3

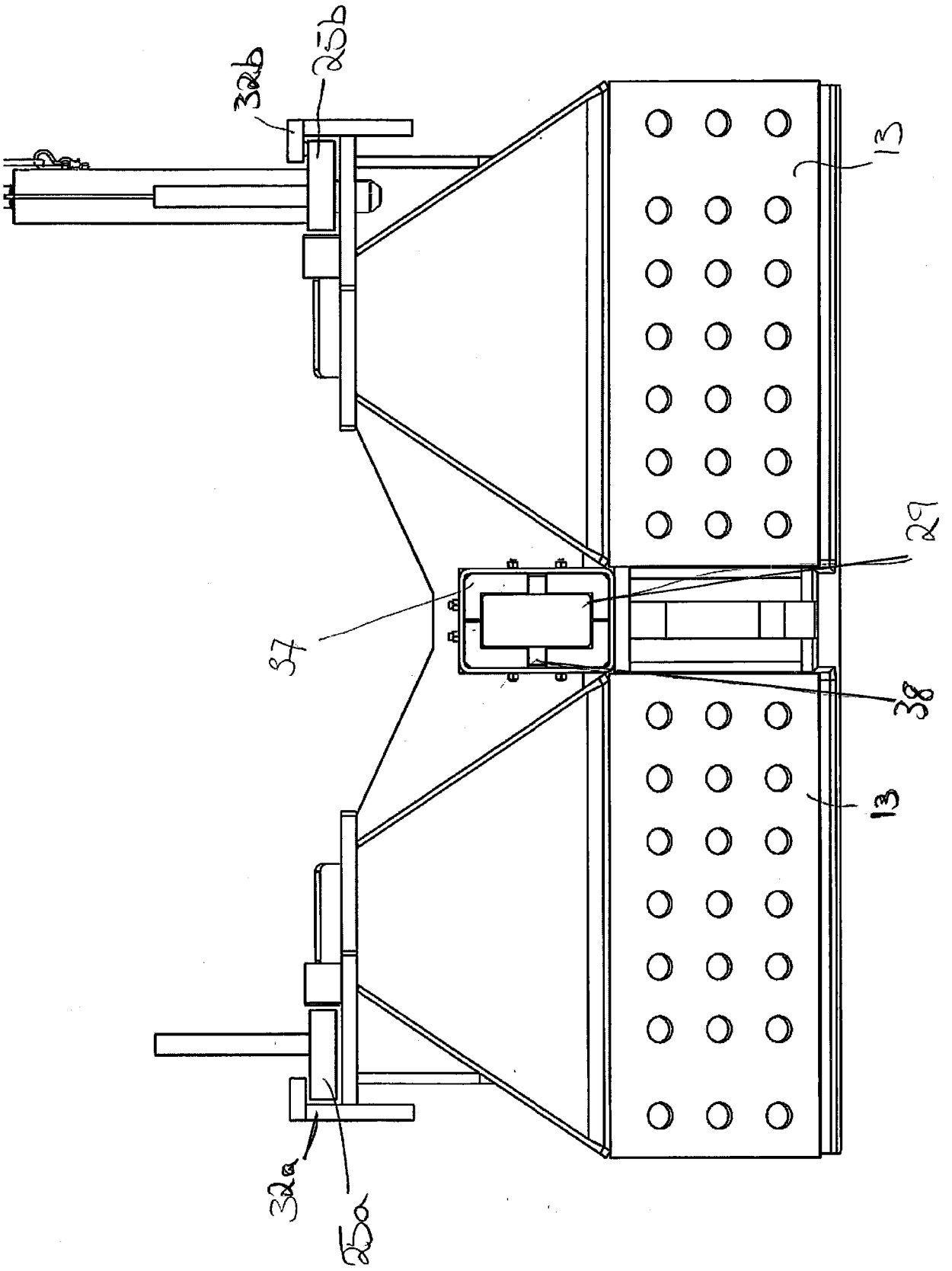


Fig. 4a

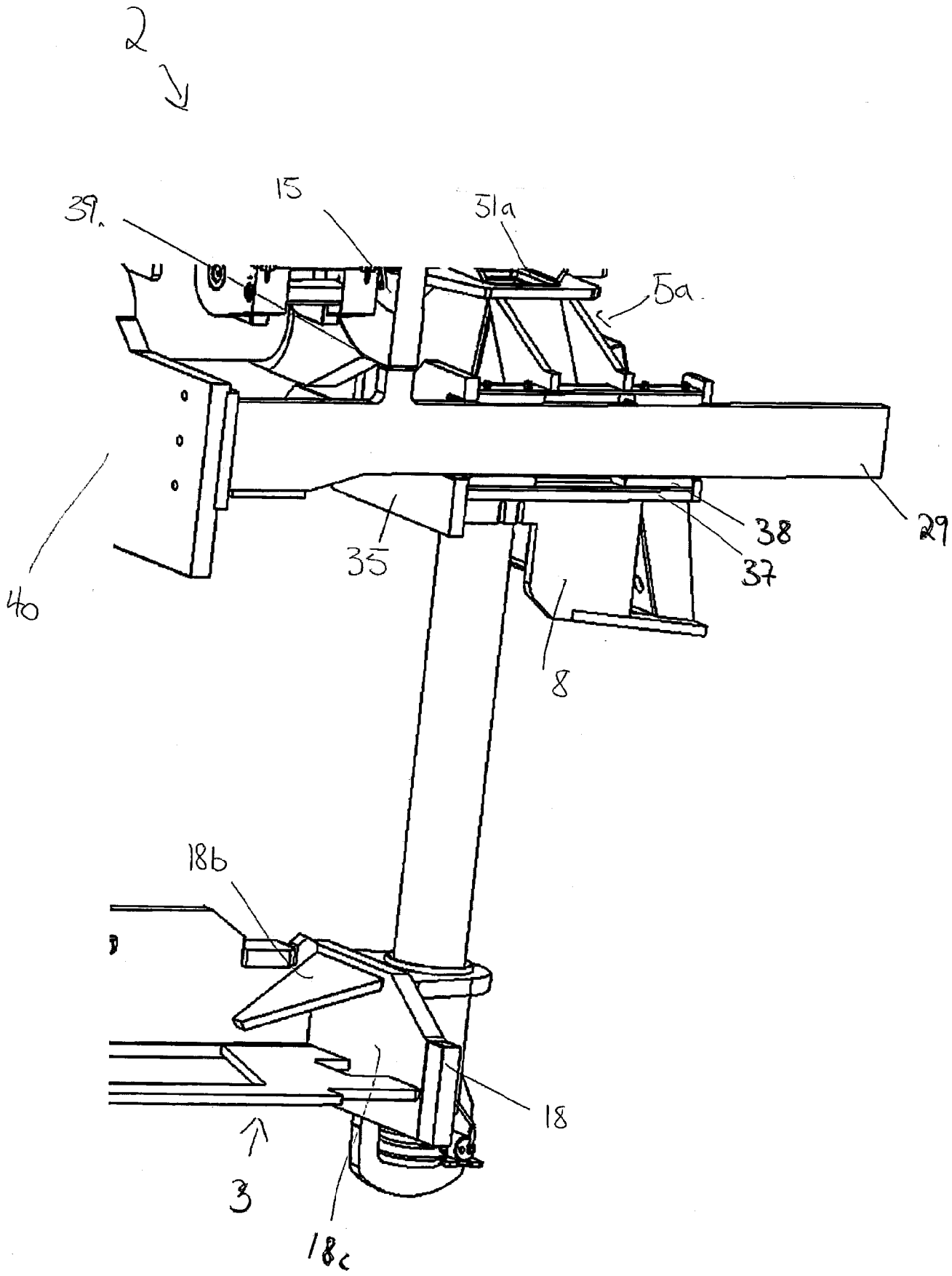


Fig. 4b

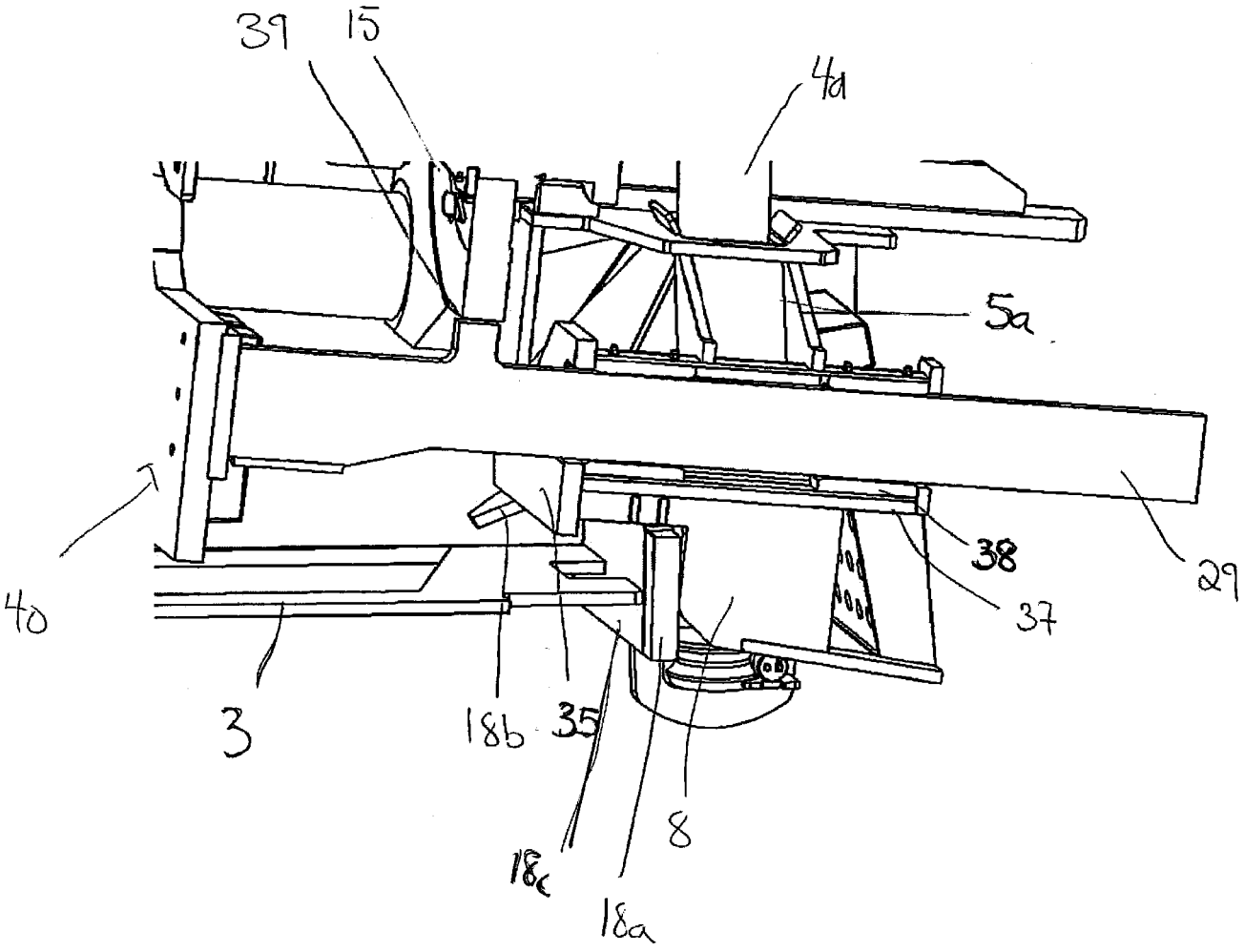


Fig. 4c

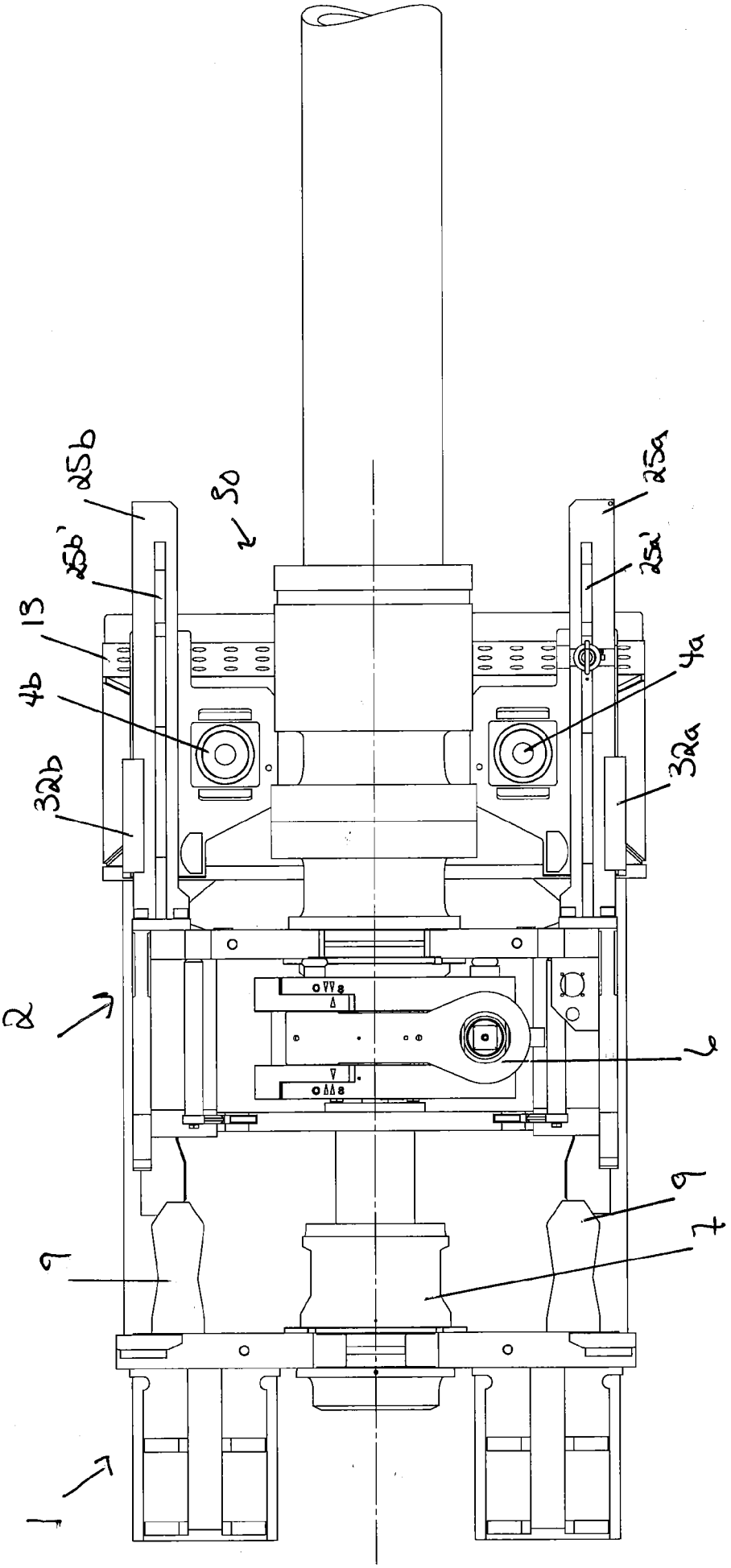


Fig. 5

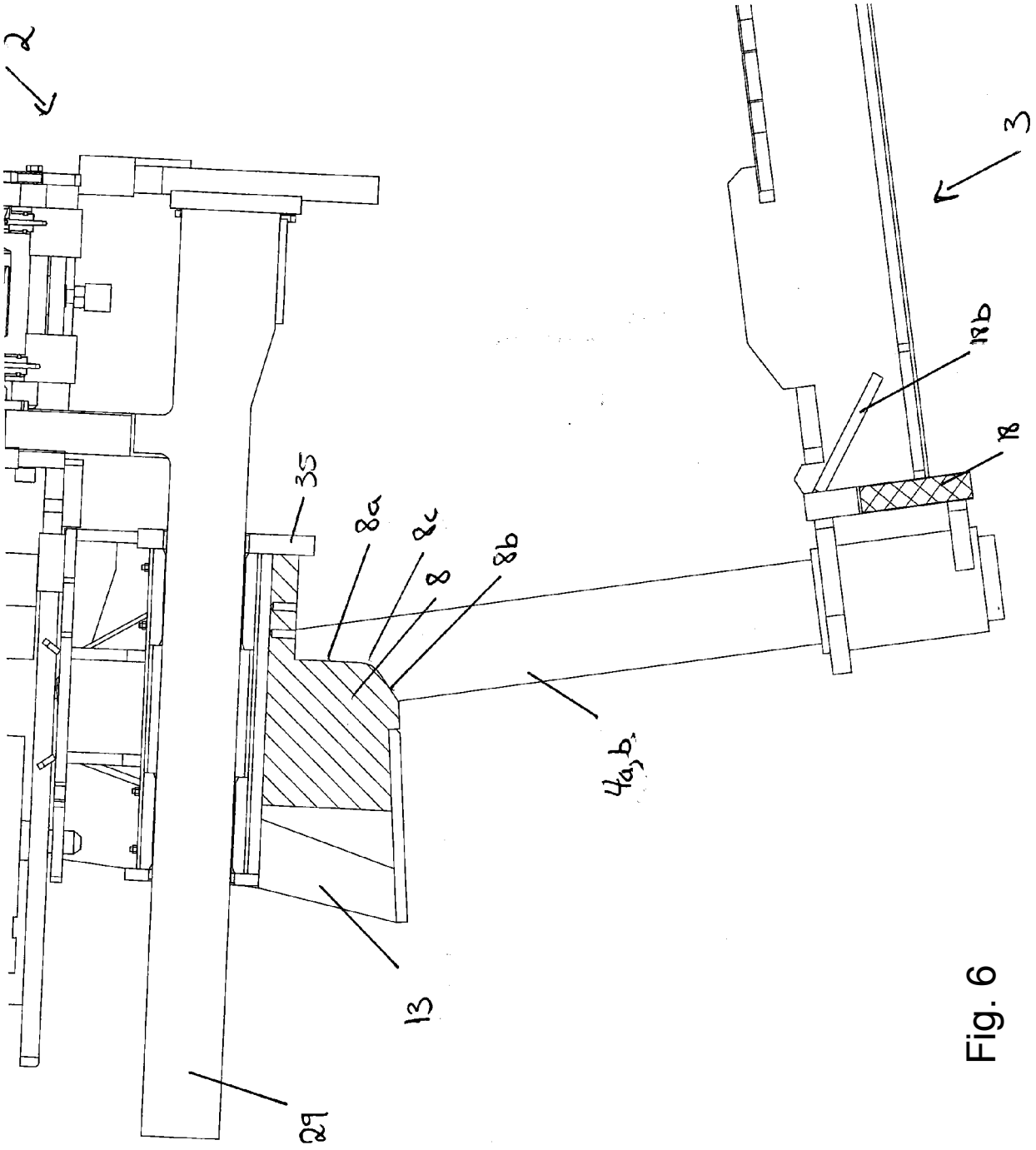


Fig. 6

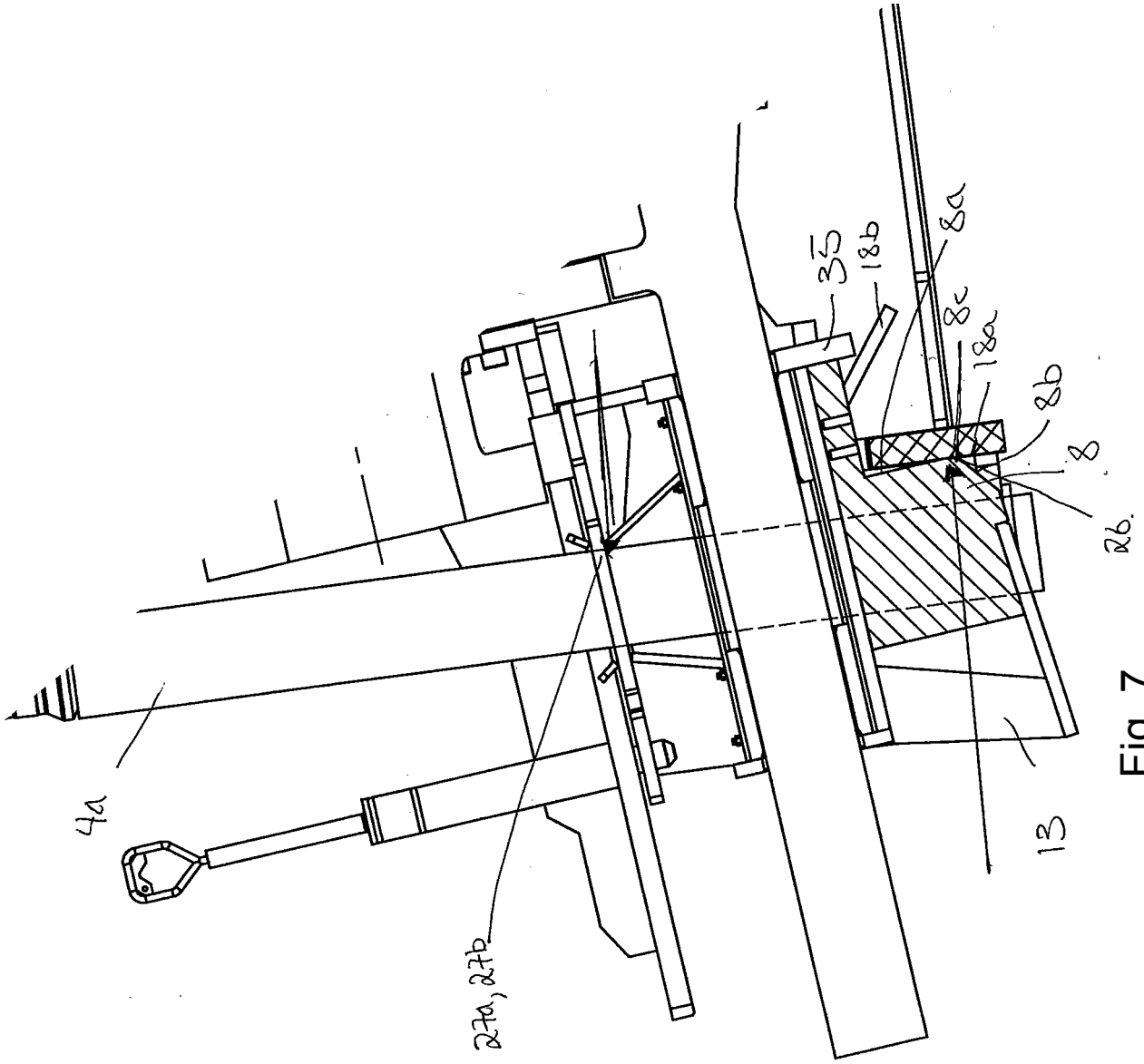


Fig. 7

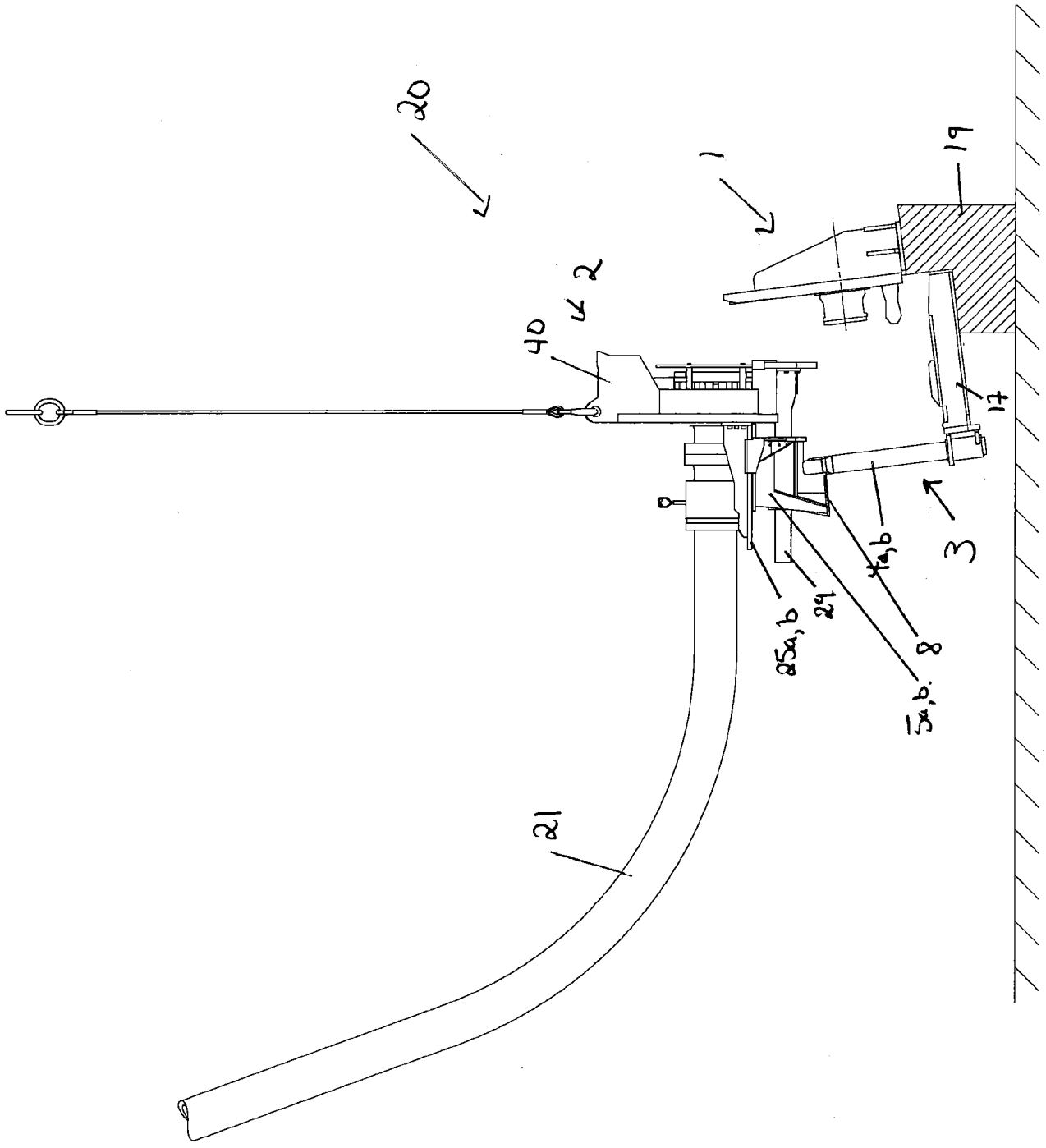


Fig. 8

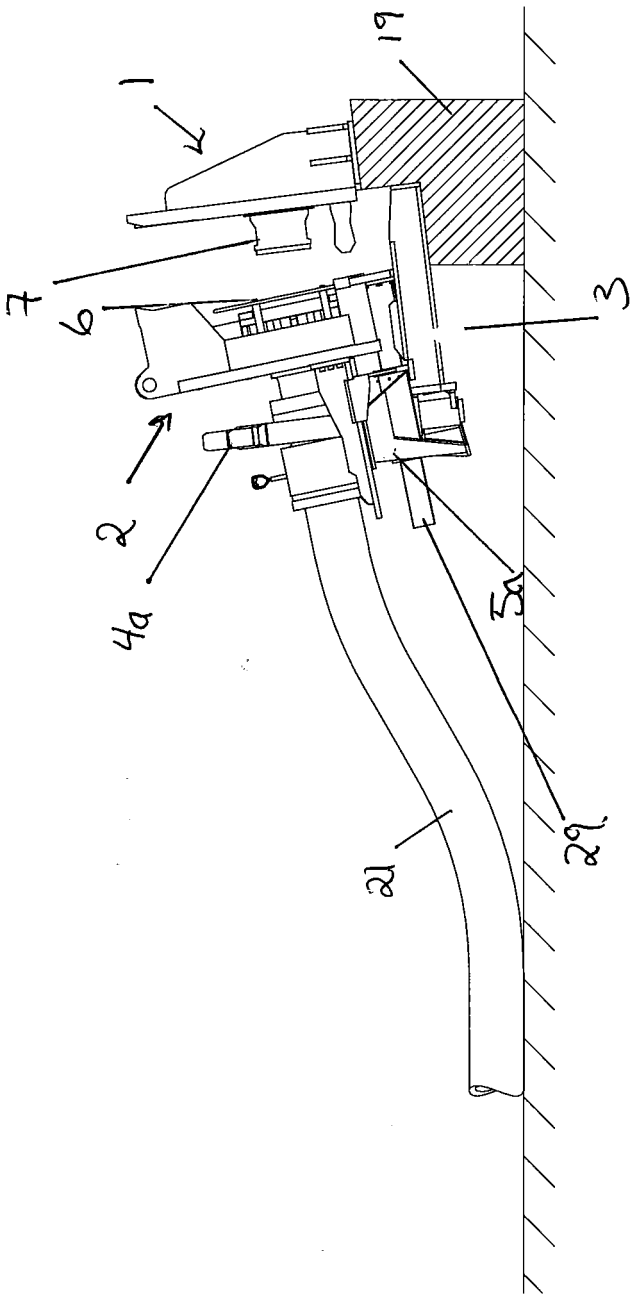


Fig. 9

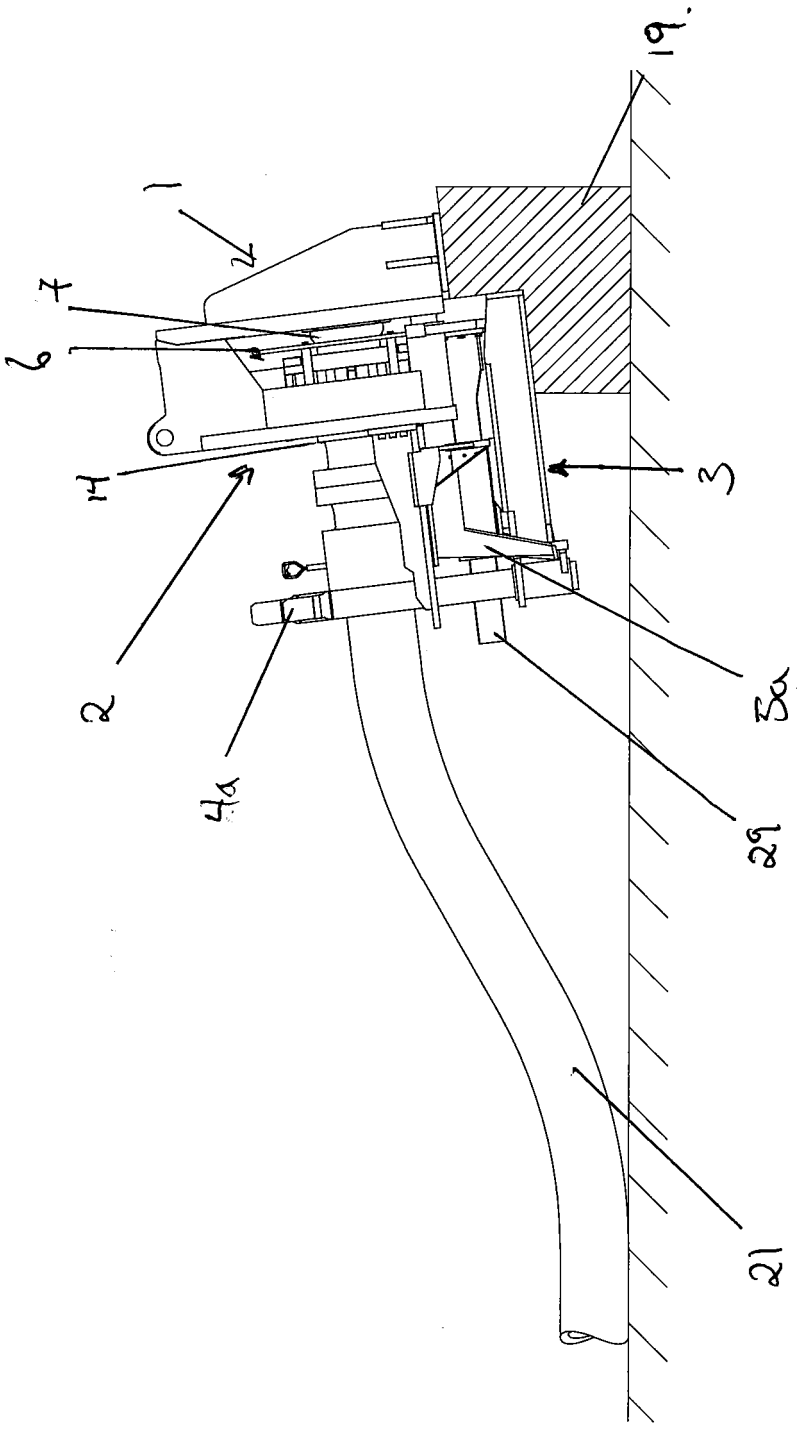


Fig. 10

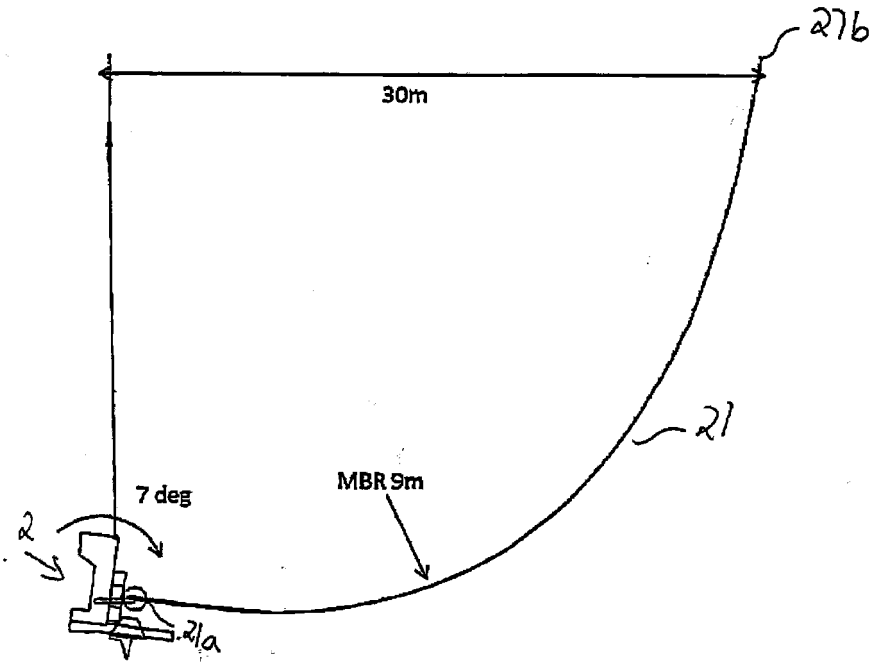


Fig. 11