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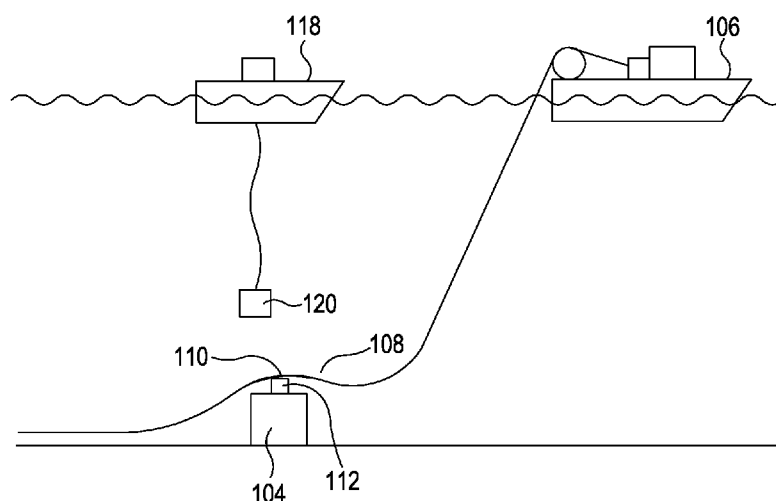


Figure 1B

(57) Abstract: A method of installing a subsea pipeline for tie-in to a subsea structure. The method comprises laying, using a pipe laying vessel, an intermediate section of the pipeline on to a pipe restraint device, wherein the pipe restraint device is at or near the subsea structure, or is at or near a location at which a subsea structure will be installed, and the pipe restraint device restricts transverse movement of the pipeline. The intermediate section of the pipeline is configured to be tapped at or near the pipe restraint device for providing fluid communication between the pipeline and the subsea structure.



PIPELINE DEPLOYMENT AND TIE-IN METHOD

Technical Field

- 5 The present invention relates to the deployment and tie-in of subsea pipelines used for the transportation of hydrocarbons.

Background

- 10 Pipelines for the transport of hydrocarbons, e.g. oil or gas, are typically laid along the seabed using a laying vessel. Such subsea pipelines can be installed between, for example, two subsea structures, where the subsea structures may be “christmas trees”, riser bases, manifolds, templates or some other structures. Often one or both ends of the pipeline are connected (or “tied-in”) to a subsea structure using a separate
- 15 jumper or spool. Direct tie-in methods can also be used. Direct tie-in methods include: direct pull-in, in which an end of the pipeline is pulled close to the subsea structure using a winch located on the laying vessel, and the tie-in is completed using a remotely operated vehicle (ROV) and alignment apparatus; deflect to connect, in which a wire is attached to the end of the pipeline, where the wire is routed through the subsea
- 20 structure to a winch, and the wire is used to pull the subsea end of the pipeline directly to the subsea structure; and connect and lay-away, in which the subsea end of the pipeline is connected to the subsea structure at the surface, and the subsea structure is then lowered to the seabed before the laying vessel lays the pipeline by stepping away from the subsea structure.

- 25 A typical approach to pipelaying will involve careful design of the subsea structure and of the pipeline configuration in order to ensure that, when laid, the tie-in end of the pipeline is in the correct location and orientation with respect to the connector on the subsea structure.

- 30 During the direct tie-in process, a high tensile force may be applied to the end of the pipeline, putting the pipeline under tension, in order to bring the end of the pipeline up to the connection point and complete the tie-in process. The forces applied to the pipeline during direct tie-in can be high. This makes high demands of the installation
- 35 equipment and pipeline structure. Furthermore, at least in the absence of some

compensating mechanism, the forces can cause damage to the pipeline and to the connector on the subsea structure.

5 As set out above, typical pipeline tie-in procedures may require the application of large forces and complicated procedures to connect an end connection of a pipeline, or to bring a pipeline to a position where connection via a jumper or similar flowline is possible.

Summary of Invention

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It is an object of the present invention to overcome or at least mitigate the problems identified above.

15

According to a first aspect of the present invention there is provided a method of installing a subsea pipeline for tie-in to a subsea structure, comprising: laying, using a pipe laying vessel, an intermediate section of the pipeline on to a pipe restraint device, wherein the pipe restraint device is at or near the subsea structure, or is at or near a location at which a subsea structure will be installed, and the pipe restraint device restricts transverse movement of the pipeline, wherein the intermediate section of the pipeline is configured to be tapped at or near the pipe restraint device for providing fluid communication between the pipeline and the subsea structure.

20

The pipe restraint device may be a pipe guide, a pipe gripper, a pipe clamp or a pipe tapping clamp.

25

The pipe restraint device may be in a first configuration that permits longitudinal movement of the pipeline.

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The pipe restraint device may not be a pipe tapping clamp, and the method may further comprise installing a pipe tapping clamp at or near the pipe restraint device.

The subsea structure may be in situ on the seabed, and the subsea structure may comprise the pipe restraint device.

The subsea structure may be in situ on the seabed, and the pipe restraint device may be a pipe tapping clamp that is pre-installed in the subsea structure.

5 The method may further comprise moving the pipe restraint device to a second configuration in which the pipeline is clamped by the pipe restraint device to restrict longitudinal movement of the pipeline.

10 The method may further comprise: clamping the pipeline using a pipe tapping clamp to thereby restrict longitudinal movement of the pipeline; and tapping the pipeline through the pipe tapping clamp. The method may still further comprise connecting a conduit between the pipe tapping clamp and the subsea structure to thereby provide fluid communication between the pipeline and the subsea structure. The pipeline may be tapped before production of hydrocarbons through the pipeline begins. The pipeline may be tapped after production of hydrocarbons through the pipeline has begun.

15 The intermediate section of the pipeline may include a prepared section of the pipeline.

20 According to a second aspect of the present invention there is provided a subsea structure comprising a pipe restraint device, wherein the pipe restraint device is configured to receive an intermediate section of a pipeline laid from a pipe laying vessel, wherein the intermediate section of the pipeline is configured to be tapped at or near the pipe restraint device for providing fluid communication between the pipeline and the subsea structure.

25 The subsea structure may be a template, manifold or Christmas tree.

Embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:

30 Brief Description of Drawings

Figure 1A shows an initial stage of the installation method, with a pipeline being deployed from a laying vessel.

Figure 1B shows a later stage of the installation method, after an intermediate section of the pipeline has been laid on to a pipe restraint device.

5 Figure 1C illustrates the installation method for a case in which a pipeline has been laid over multiple subsea structures.

Figure 2A shows a pipe tapping clamp as an example of a pipe restraint device.

10 Figure 2B illustrates a seal of the pipe tapping clamp shown in Figure 2A.

Figure 3A illustrates an initial stage of a process of tapping the pipeline through a pipe tapping clamp, using a pipe-tapping device.

15 Figure 3B illustrates a subsequent stage of a process of tapping the pipeline through a pipe tapping clamp, using a pipe-tapping device.

Figure 3C illustrates further subsequent stage of a process of tapping the pipeline through a pipe tapping clamp, using a pipe-tapping device.

20 Figure 4 shows a high-level flow diagram describing the method.

Detailed Description

25 The invention relates to a method for installing a subsea pipeline for tie-in to a subsea structure. The method comprises laying, using a pipe laying vessel, an intermediate section of the pipeline on to a pipe restraint device, wherein the pipe restraint device is at or near the subsea structure, or is at or near a location at which a subsea structure will be installed, and the pipe restraint device restricts transverse movement of the pipeline. The intermediate section of the pipeline is a portion of the pipeline located
30 between the two ends of the pipeline. Where the pipe restraint device is part of the subsea structure, the pipeline is laid therefore laid over the subsea structure. The pipe restraint device may be located at or near a location at which a subsea structure will be, or may be, installed in the future. In this case, the pipeline can be laid over the pipe restraint device to facilitate easy tie-in to the subsea structure when, or if, the subsea
35 structure is eventually installed at the seabed.

The intermediate section of the pipeline is configured to be tapped at or near the pipe restraint device for providing fluid communication between the pipeline and the subsea structure. The method of the invention allows a pipeline to be laid continuously, while
5 still ensuring that the pipeline is held in a position that will allow tie-in to a subsea structure. This is advantageous because there is no need to cut, position, and potentially tie-in an end of a pipeline as part of the laying process, procedures which are complicated, expensive and time-consuming. The pipe restraining device initially restricts transverse movement of the pipeline, i.e. movement of the pipeline
10 substantially orthogonal to the direction in which the pipeline is laid, but does not restrict longitudinal movement of the pipeline. This allows the pipeline to move longitudinally during the laying process, mitigating the forces on the pipeline, since the pipeline is allowed to settle into a rest position. The method therefore removes, or at least mitigates, the need for the application of large forces during a tie-in procedure,
15 reducing the likelihood of damage to equipment.

Figure 1A shows an initial stage of the method. A pipe laying vessel 106 at the surface 116 of a body of water moves in a forward direction and deploys a pipeline 102. The pipeline 102 is e.g. a production pipeline configured to transport produced
20 hydrocarbons. The pipeline 102 is laid along the seabed 114, or the bed of the body of water. A subsea structure 104 is located on the seabed 114. In one embodiment the subsea structure 104 is a structure associated with a well in a formation beneath the seabed 114. In this embodiment the subsea structure is e.g. one or more of a template, a drilling template, a Christmas tree (XMT) and a manifold. In an alternative
25 embodiment the subsea structure is a support structure associated with a future pipeline junction or pipeline tie-in, e.g. a scaffolding and/or manifold that will be used to facilitate a future connection to a second pipeline. In the embodiment shown in Figure 1A the subsea structure 104 includes a pipe restraint device 112. Alternatively, the pipe restraint device 112 is separate from, but located near, the subsea structure 104. In a
30 further alternative embodiment the pipe restraint device 112 is located at or near the seabed 114, and no subsea structure is yet present. In this case, the pipe restraint device 112 is located at or near a location at which a subsea structure will be, or may be, installed in the future.

The pipe restraint device 112 is any device capable of holding a pipeline and restricting the movement of the pipeline. For example, the pipe restraint device is a pipe guide, a pipe gripper, a pipe clamp or a pipe tapping clamp. A second vessel 118 and a remotely operated underwater vehicle (ROV) 120 controlled from the second vessel 118 may be used in the method. The pipeline 102 has an intermediate section 108 to be laid on to the pipe restraint device 112. The intermediate section 108 does not include any end portion of the pipeline, and is preferably distant from an end of the pipeline. The intermediate section 108 may include a prepared section 110 of the pipeline which has been made ready for a tapping procedure. In one embodiment the prepared section 110 is a polished section of the pipeline. In particular, the polished section has been cleaned and any unneeded outer coatings have been removed, to facilitate a good seal with a tapping clamp. In an alternative embodiment the prepared section of the pipeline comprises a coating that is applied only to the prepared section. In a further alternative embodiment the prepared section includes circumferential grooves cut into the surface of the pipeline to accommodate a tapping clamp. The prepared section 110 may be longer than is strictly required to facilitate a good seal with a tapping clamp. That is, the prepared section may extend beyond the pipe restraint device, tapping clamp and/or subsea structure once the pipeline has been laid on to the pipe restraint device. For example, the prepared section may extend 5 m beyond each end of the pipe restraint device. This extra length of the prepared section provides greater flexibility for laying the pipeline on to the pipe restraint device, by accounting for lower accuracy in laying the pipeline and/or shifts in the pipeline's position once the pipeline has been laid on to the pipe restraint device.

Figure 1B shows a subsequent stage of the method. As the pipe laying vessel 106 moves forward and deploys the pipeline 102, the intermediate section 108 of the pipeline 102 is laid on to the pipe restraint device 112. In the embodiment shown in Figure 1B the pipe restraint device 112 is included in the subsea structure 104 and the pipeline is laid over the subsea structure 104. In the case that the pipe restraint device 112 is separate from the subsea structure 104, or extends horizontally from the subsea structure 104, or is located on the seabed at or near a location at which a subsea structure will be or may be installed in the future, the pipeline may be laid over the pipe restraint device such that the subsea structure 104 is not located beneath the pipeline 102.

In the embodiment shown in Figure 1B the prepared section 110 of the pipeline is laid on to the pipe restraint device. Alternatively, if the pipe restraint device 112 is not a pipe tapping clamp, a section of the pipeline 102 adjacent to the prepared section 110 may be laid on to the pipe restraint device 112. The ROV 120 may be used to help lay the pipeline 102 on to the pipe restraint device 112. Other techniques may be used to move the pipeline into position on the pipe restraint device. For example, a pull-in wire extending from a vessel may be used, optionally in combination with a winch and/or pulleys. In the embodiment shown in Figure 1A the pipe restraint device 112 is in an open state configured to receive the pipeline. Once the pipeline has been laid on to the pipe restraint device 112, the pipe restraint device is moved to a first configuration in which transverse motion of the pipeline is restricted, but longitudinal motion of the pipeline is not restricted. The ROV 120 may be used to move the pipe restraint device from the open state to the first configuration. Alternatively, the pipe restraint device may include a sprung clip, a v-shaped pipe guide, or other similar components so that it is not necessary to move the restraint device into a different configuration in order to restrict transverse motion of the pipeline, such that transverse motion of the pipeline is restricted once the pipeline has been laid on to the pipe restraint device, and no further operations are necessary to achieve this.

Figure 1C shows a still later, optional, stage of the method in which the pipeline is laid over further pipe restraint devices 132,142. Once the pipeline has been laid over the first pipe restraint device 112 as set out above in relation to Figure 1A and Figure 1B, the same procedure can be used to lay the pipeline over further pipe restraint devices. In the embodiment shown in Figure 1C the pipeline 102 has been laid over a first pipe restraint device 112 and subsea structure 104, and the pipeline's transverse motion is restricted by pipe restraint device 112. The pipeline 102 has also been laid over a second pipe restraint device 132 and subsea structure 124, and will be laid over a third pipe restraint device 142 and subsea structure 134. In the pipeline installation method illustrated in Figure 1C the pipeline is restrained at certain locations, i.e. at the pipe restraint devices 112,132,142, to facilitate tie-in to subsea structures, but the method does not require time-consuming and complex tie-in procedures to be performed as part of the pipeline laying operation. This means that the pipeline can be laid essentially or almost continuously, saving on vessel time and costs.

Figures 2A and 2B show a pipe tapping clamp as an example of a pipe restraint device. Figure 2A shows a pipe tapping clamp 260 in an open configuration and a pipeline 202 extending through the open pipe tapping clamp 260. In Figure 2A the intermediate section of the pipeline 202 is not a prepared section of the pipeline, but preferably the intermediate section will be prepared. In Figure 2A the pipe tapping clamp 260 is shown in a vertically downward orientation in which a clamping portion 268 of the pipe tapping clamp 260 is vertically underneath and supported by a supporting structure 266 of the pipe tapping clamp 260. The pipe tapping clamp 260 may be installed in a different orientation to facilitate laying of the pipeline 202 on to the pipe tapping clamp 260. For example, the pipe tapping clamp may be in a vertically upward orientation in which the clamping portion 268 is vertically above the supporting structure 266. Alternatively, the pipe tapping clamp may be in a horizontal or angled orientation in which the clamping portion 268 is not centred in the same vertical plane as the supporting structure 266. Figure 2B shows the pipe tapping clamp of Figure 2A in a different configuration, and illustrates a seal 264 of the pipe tapping clamp 260. In a tapping operation (described in more detail below) the seal or seals 264 will be brought into close contact with the prepared section of the pipeline 202, to ensure that no fluid will leak out of the pipe tapping clamp 260. As set out above, the pipe restraint device may alternatively be a pipe guide or a pipe gripper. The pipe tapping clamp may be included in an apparatus that also includes a pipe gripper and/or a pipe guide.

If the pipe restraint device is not a pipe tapping clamp 260 (e.g. if the pipe restraint device is a pipe guide 250 or pipe gripper 270), it will be necessary at some stage to connect a pipe tapping clamp to the pipeline, to allow fluid communication to be provided between the pipeline and the subsea structure. In one embodiment the pipe tapping clamp is already *in situ* before the pipeline is laid. The *in situ* pipe tapping clamp may be included in the subsea structure, or may be separate from any subsea structure. Alternatively, the pipe tapping clamp is installed at any time after the pipeline has been laid on to the pipe restraint device. If a subsea structure is already *in situ* (either separate from, or including, the pipe restraint device), the pipe tapping clamp may be installed in the subsea structure at a later stage. In this way the method of the invention allows a pipeline to be laid quickly and efficiently, while providing the infrastructure to facilitate simple and low-cost tie in to a subsea structure at any time after the pipeline is laid. The pipe restraint device restricts transverse (and sometimes longitudinal) movement of the pipeline. The pipe tapping clamp is preferably located

close to the pipe restraint device, because the location of the pipeline is more certain near to the pipe restraint device. If the pipe tapping clamp is *in situ* before the pipeline is laid, the pipeline may be laid over the pipe restraint device and the pipe tapping clamp in the same laying operation, e.g. as described for Figures 1A and 1B. In this case the pipe tapping clamp may be left open until a tapping operation is begun, or the pipe tapping clamp may be partially or fully closed to ensure that the pipeline is retained within the pipe tapping clamp. If the pipe tapping clamp is installed at some time after the pipeline has been laid on to the pipe restraint device, the pipe tapping clamp is preferably installed and coupled to the pipeline without the application of large forces to the pipeline. For example, the pipe tapping clamp may be coupled to the pipeline using an ROV, or if the pipe tapping clamp is part of a subsea structure, the subsea structure may be installed in a location that permits the pipe tapping clamp to be coupled to the pipeline without the application of large forces to the pipeline. Alternatively, it may be necessary to move the pipeline, e.g. using a winch and pull-in line, to facilitate the coupling of the pipe tapping clamp to the pipeline.

After the operations described above for Figures 1A and 1B (and optionally Figure 1C), the pipe restraint device 112 is in a first configuration in which the transverse motion of the pipeline is restricted. At some point before a tapping operation is begun it is necessary to also restrict longitudinal motion of the pipeline. To achieve this, the pipe restraint device is moved into a second configuration in which transverse and longitudinal motion of the pipeline is restricted. If the pipe restraint device is a pipe tapping clamp 260, in the first configuration the pipe tapping clamp may be partially or fully closed, but without fully clamping down on the pipeline. In the second configuration the pipe tapping clamp is fully closed and is fully clamping down on the pipeline, with the seal 264 engaged with the surface of the pipeline 202. If the pipe restraint device is a pipe gripper, in the first configuration the pipe gripper may loosely grip the pipeline, and in the second configuration the pipe gripper tightly grips the pipeline. If the pipe restraint device 112 is not a pipe tapping clamp 260, then, as set out above, a pipe tapping clamp must at some stage be coupled to the pipeline. If a pipe restraint device and a pipe tapping clamp are coupled to the pipeline, the longitudinal motion of the pipeline can be restricted using the pipe restraint device and/or the pipe tapping clamp. The longitudinal motion of the pipeline can be restricted using the pipe restraint device and/or a pipe tapping clamp at any time after the pipeline has been laid over the pipe restraint device. However, it is preferable to wait

for the pipeline laying operation to be fully completed, and for the pipeline to settle into a rest position, before the pipeline is clamped to restrict its longitudinal motion.

5 Figures 3A, 3B and 3C illustrate a procedure for tapping the pipeline 302 to provide fluid communication between the pipeline 302 and a subsea structure. The tapping procedure can be carried out before production begins through the pipeline, i.e. 'cold tapping', or after production through the pipeline has begun, i.e. 'hot tapping'.

10 In an initial step of the tapping procedure shown in Figure 3A, the pipeline 302 is held in the pipe tapping clamp 360. In particular, the pipeline 302 is clamped in the pipe tapping clamp 360 such that transverse movement and longitudinal movement of the pipeline 302 is restricted, and preferably prevented entirely. The seal 264 shown in Figure 2B is engaged with the prepared section of the pipeline 302, preventing the passage of fluid from one side of the seal to the other, i.e. preventing fluid leaks. The
15 pipe tapping clamp 360 includes a valve or seal 362 that is initially open, as shown in Figure 3A. There is no fluid communication between the pipeline and the pipe tapping clamp. A cutting or milling device 380 including a blade 382 is coupled to the pipe tapping clamp 360 such that the blade 382 is located within a conduit 365 of the pipe tapping clamp 360. The cutting device 380 may be transported to the pipe tapping
20 clamp, and coupled to the pipe tapping clamp using an ROV. Alternatively, the cutting device is included in the pipe tapping clamp. The cutting device may be operated using the ROV. In a subsequent step shown in Figure 3B, the cutting device extends through the conduit 365 of the pipe tapping clamp and the blade 382 engages with the pipeline 302. A section of the pipeline is cut out using the blade, and the cutting device retains
25 the cut-out section of the pipeline. As shown in Figure 3C, the cutting device retracts back through the conduit of the pipe tapping clamp carrying the cut-out section of the pipeline, and the valve or seal 362 is closed, preventing any fluid from exiting the pipe tapping clamp. The cutting device will subsequently be de-coupled and from the pipe tapping clamp. The pipe tapping clamp includes fluid ports to which fluid lines may be
30 connected. Each of the fluid ports may be capped/sealed to prevent any exit of fluid. In the configuration shown in Figure 3C, there is fluid communication between the pipeline and the conduit of the pipe tapping clamp. Once the cutting device has been removed, the valve is closed and/or the fluid port(s) of the tapping clamp are capped, the pipe tapping clamp can be left in situ, coupled to the pipeline, for any length of time
35 required.

In a subsequent operation (not shown in the Figures), fluid communication is provided between the pipeline and the subsea structure. The pipe tapping clamp may include a manifold that is in fluid communication with the conduit of the pipe tapping clamp. In this case a jumper or flowline will be connected between the manifold and the subsea structure. Alternatively, an apparatus including the pipe tapping clamp may also include a manifold that is not in fluid communication with the pipe tapping clamp, or the subsea structure may include a manifold. In this case a jumper or flowline is coupled between the conduit of the pipe tapping clamp and the manifold, and the manifold is connected to the subsea structure if required. The valve 362 is then opened to provide fluid communication between the pipeline and the subsea structure, via the conduit of the pipe tapping clamp and a manifold.

Figure 4 shows a high-level flow diagram describing a method in accordance with the invention. In step S402, an intermediate section (108) of a pipeline (102) is laid on to a pipe restraint device (112) using a pipe laying vessel (106), wherein the pipe restraint device (112) is at or near the subsea structure (104), or is at or near a location at which a subsea structure will be installed, and the pipe restraint device (112) restricts transverse movement of the pipeline (102). The intermediate section (108) of the pipeline (102) is configured to be tapped at or near the pipe restraint device (112) for providing fluid communication between the pipeline (102) and the subsea structure (104).

It will be appreciated by the person of skill in the art that various modifications may be made to the above described embodiments without departing from the scope of the present invention.

Claims

1. A method of installing a subsea pipeline (102) for tie-in to a subsea structure (104), comprising:
 - 5 laying, using a pipe laying vessel (106), an intermediate section (108) of the pipeline (102) on to a pipe restraint device (112), wherein the pipe restraint device (112) is at or near the subsea structure (104), or is at or near a location at which a subsea structure will be installed, and the pipe restraint device (112) restricts transverse movement of the pipeline (102),
 - 10 wherein the intermediate section (108) of the pipeline (102) is configured to be tapped at or near the pipe restraint device (112) for providing fluid communication between the pipeline (102) and the subsea structure (104).
2. The method of claim 1, wherein the pipe restraint device is a pipe guide, a pipe gripper, a pipe clamp or a pipe tapping clamp.
 - 15
3. The method of claim 1 or claim 2, wherein the pipe restraint device is in a first configuration that permits longitudinal movement of the pipeline.
4. The method of any one of claims 1 to 3, wherein the pipe restraint device is not a pipe tapping clamp, and the method further comprises installing a pipe tapping clamp at or near the pipe restraint device.
 - 20
5. The method of any one of the preceding claims, wherein the subsea structure is in situ on the seabed, and the subsea structure comprises the pipe restraint device.
 - 25
6. The method of any one of claims 1 to 3, wherein the subsea structure is in situ on the seabed, and the pipe restraint device is a pipe tapping clamp that is pre-installed in the subsea structure.
 - 30
7. The method of any one of the preceding claims, further comprising moving the pipe restraint device to a second configuration in which the pipeline is clamped by the pipe restraint device to restrict longitudinal movement of the pipeline.
8. The method of any one of the preceding claims, further comprising:
 - 35

clamping the pipeline using a pipe tapping clamp to thereby restrict longitudinal movement of the pipeline; and

tapping the pipeline through the pipe tapping clamp.

5 9. The method of claim 8, further comprising connecting a conduit between the pipe tapping clamp and the subsea structure to thereby provide fluid communication between the pipeline and the subsea structure.

10 10. The method of claim 8 or claim 9, wherein the pipeline is tapped before production of hydrocarbons through the pipeline begins.

11. The method of claim 8 or claim 9, wherein the pipeline is tapped after production of hydrocarbons through the pipeline has begun.

15 12. The method of any one of the preceding claims, wherein the intermediate section of the pipeline includes a prepared section of the pipeline.

20 13. A subsea structure comprising a pipe restraint device, wherein the pipe restraint device is configured to receive an intermediate section of a pipeline laid from a pipe laying vessel, wherein the intermediate section of the pipeline is configured to be tapped at or near the pipe restraint device for providing fluid communication between the pipeline and the subsea structure.

25 14. The subsea structure of claim 13, wherein the subsea structure is a template, manifold or Christmas tree.

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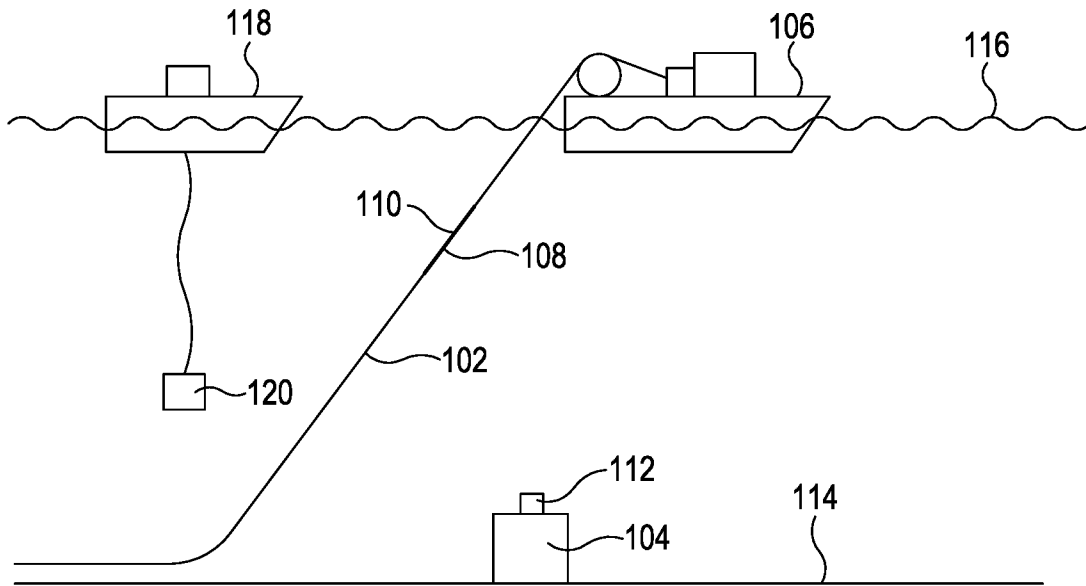


Figure 1A

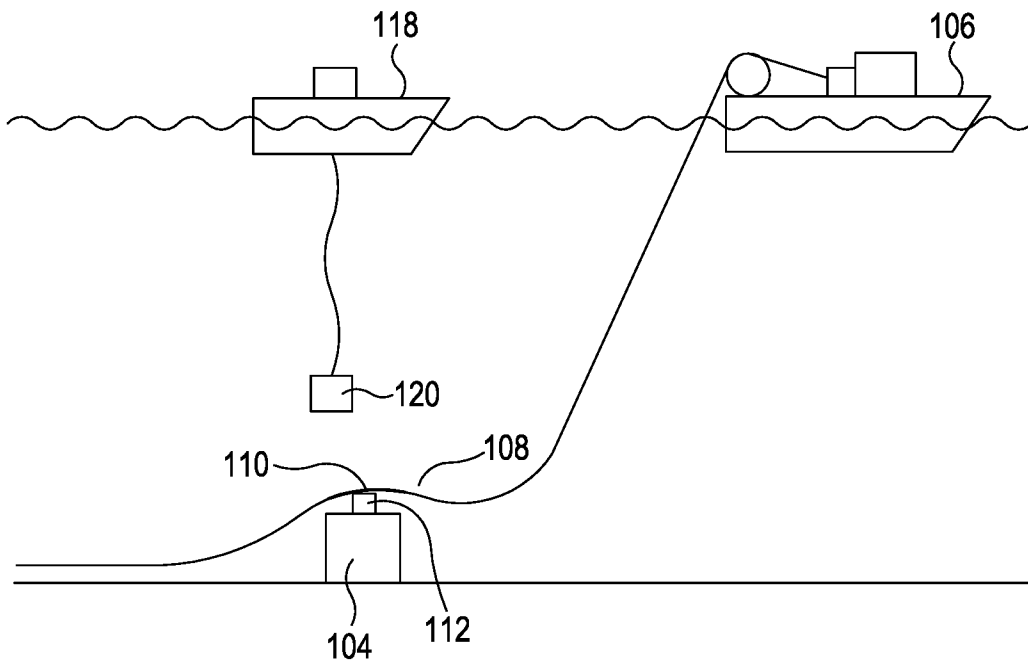


Figure 1B

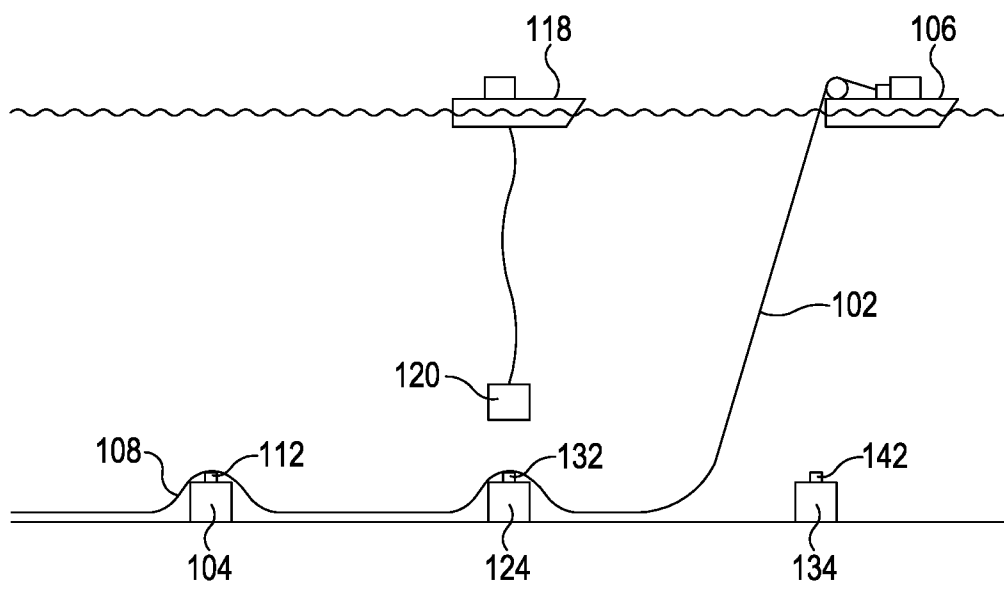


Figure 1C

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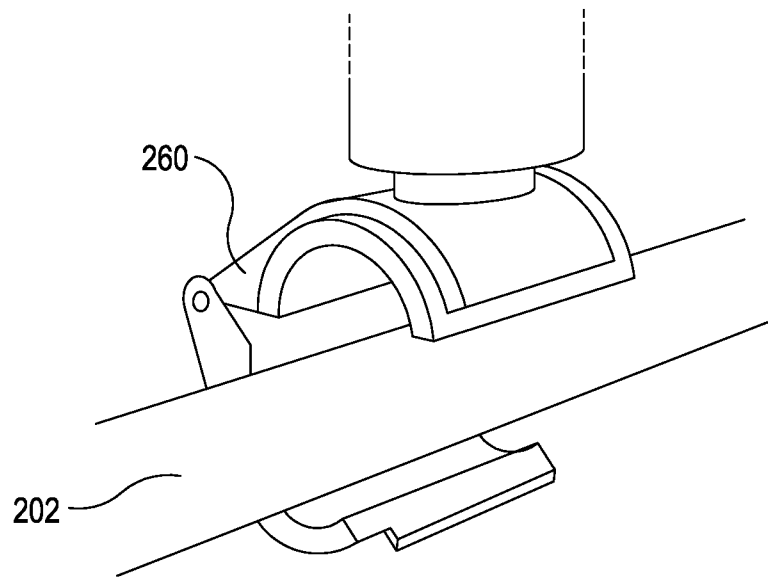


Figure 2A

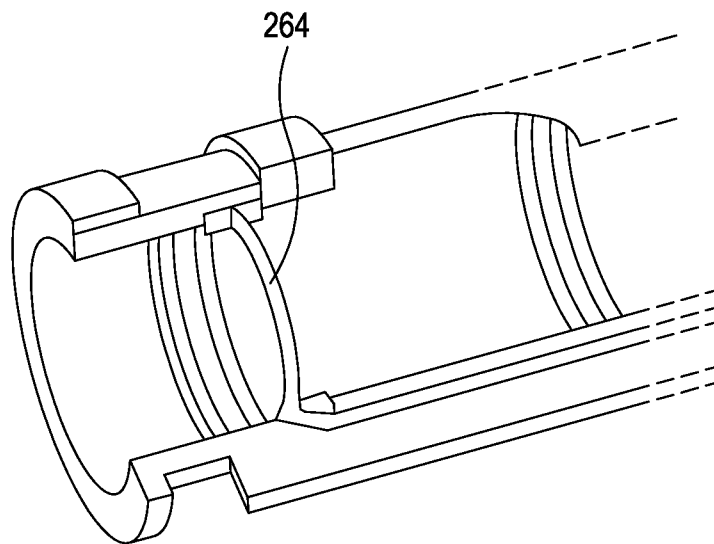


Figure 2B

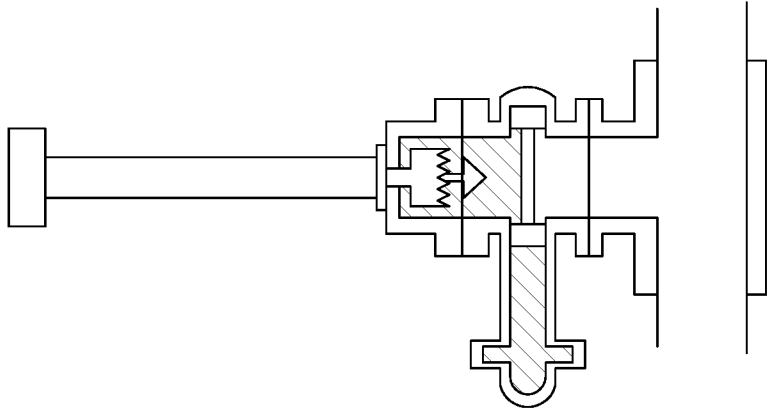


Figure 3C

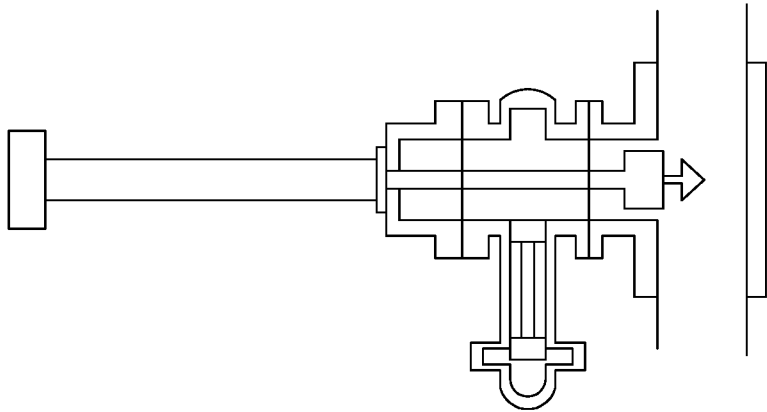


Figure 3B

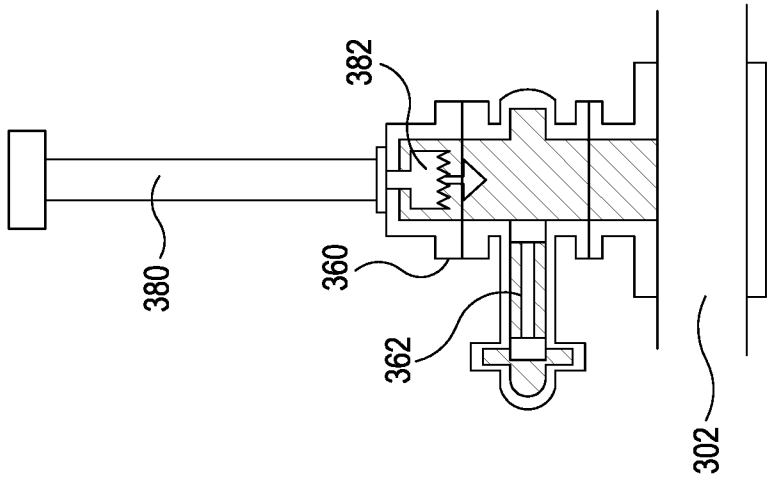


Figure 3A

S402

Lay, using a pipe laying vessel, an intermediate section of a pipeline on to a pipe restraint device, wherein the pipe restraint device is at or near the subsea structure, or is at or near a location at which a subsea structure will be installed, and the pipe restraint device restricts transverse movement of the pipeline, wherein the intermediate section of the pipeline is configured to be tapped at or near the pipe restraint device for providing fluid communication between the pipeline and the subsea structure.

Figure 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO2020/050063

A. CLASSIFICATION OF SUBJECT MATTER E21B 43/013 (2006.01), F16L 1/16 (2006.01), F16L 1/26 (2006.01) 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) E21B, F16L Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched DK, NO, SE, FI: Classes as above. Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPODOC, WPI, FULL TEXT: ENGLISH		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2018/111120 A1 (Statoil Petroleum AS) 2018.06.21 Figures 1 and 2; page 1 lines 8-14, page 1 line 24-page 2 line 8, page 4 lines 20-24, page 6 lines 1-32, page 8 lines 23.32, page 9 lines 24-30, page 10 lines 25-34, page 11 line 33-page 12 line 6, page 14 lines 10-12, page 21 line 7-page 22 line 13, page 27 lines 3-22, page 35 lines 9-15 and claims 1, 4, 29, 32 and 33.	1-14
A	US 6290432 B1 (Exley, G. D. et al.) 2001.09.18 The whole document.	1-14
P, A	WO 2019/076580 A1 (FMC Kongsberg AS) 2019.04.25 The whole document.	1-14
P, A	WO 2019/125174 A1 (Equinor Energy AS) 2019.06.27 Abstract, figures 1-16, page 2 lines 8-32, page 3 line 28-page 4 line 4, page 5 line 12-page 6 line 16, page 7 lines 9-18.	1-14
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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INTERNATIONAL SEARCH REPORT

International application No.

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