Title: COUPLING DEVICE FOR DREDGING PIPES AND METHOD FOR COUPLING DREDGING PIPES

Abstract: The invention relates to a pipe connection device (3) for coupling a first end part (4) of a first pipe section (2) to a second end part (4') of a second pipe section (2') to form a pipeline. The pipe connection device comprises a first pipe positioning member (5) arranged to receive the first end part, and a second pipe positioning member (5') arranged to receive the second end part. The first and second pipe positioning members (5, 5') both define a self-centring guiding path formed by a funnel-like shaped pipe positioning member for guiding the respective first and second end parts towards each other. The first and second pipe positioning members are mounted with the first and second self-centring guiding paths coaxial with respect to each other.
COUPLING DEVICE FOR DREDGING PIPES AND METHOD FOR COUPLING DREDGING PIPES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a device for attaching a first end part of a first pipe section to a second end part of a second pipe section to form a pipe system.

The invention also relates to a vessel comprising a device for attaching a first end part of a first pipe section to a second end part of a second pipe section to form a floating pipe system.

Furthermore, the invention relates to a floating pipe section and a pipe connection system for the coupling of such pipe sections.

In addition, the invention relates to a method for coupling floating pipe sections.

2. Description of the Related Art

Pipe systems or pipelines are known and are used to transport material, such as dredging materials, from a first to a second location over a water surface.

Floating pipe systems may be formed by a number of floating pipe segments which are connected to each other. The different floating pipe segments may for instance be rigid pipe segments which are mutually connected. The floating pipe segments may comprise buoyant members and may also be carried on floats or pontoons. The attached floating pipe segments can form a floating pipe system.

Other non-floating pipe systems are also known which may be constructed from individual pipe segments. WO201/072327 discloses a device for attaching subsea sections to each other to form a pipe system, the device comprising a first jaw and a second jaw for engaging the pipe sections together.

Although in theory, use of such coupling arrangements may seem straightforward, in practice it is relatively difficult to connect pipe sections especially for floating pipe sections in off-shore conditions, as mutual positioning of the floating pipe sections is disturbed by wind and waves. Furthermore, in cases where a seal or packing is provided between the pipe ends, any relative transverse movement between the pipe ends during the coupling operation may cause damage to the seal.
It would therefore be desirable to provide an alternative pipe coupling system that facilitates connection of pipe sections even in windy and wavy circumstances.

BRIEF SUMMARY OF THE INVENTION

The present invention provides for a pipe connection device for coupling a first end part of a first pipe section to a second end part of a second pipe section to form a pipeline, wherein the device comprises:

- a first pipe positioning member arranged to receive the first end part,
- a second pipe positioning member arranged to receive the second end part,

wherein the first and second pipe positioning members both define a self-centring guiding path for guiding the respective first and second end parts towards each other, wherein the first and second pipe positioning members are mounted with the first and second self-centring guiding paths coaxial with respect to each other.

The self-centring guiding paths defined by both the first and second pipe positioning members allow to bring the first and second end parts of the pipe sections in alignment with each other by moving along the guiding path. The directions of the first and second guiding paths are opposite, i.e. the self-centring directions of the guiding paths is directed towards each other.

This is particularly advantageous when using floating pipe sections that move with the waves, water current and wind off shore. The first positioning member receives the first end part and the second positioning member receives the second end part. The self-centring guiding paths are formed to allow receiving the end parts without requiring a high degree of accuracy. However, the device can be used for non-floating pipe sections as well.

When the end parts are received in the positioning members, the end parts are guided by the self-centring guiding path towards each other, not disturbed by movement of the portion of the pipe section not received by the pipe positioning member. The pipe positioning members are mounted within the device such that the self-centring guiding paths are coaxial with each other. By guiding the end parts along the guiding paths, the end parts are aligned with respect to each other. The self-centring guiding path is preferably formed by a funnel-like shaped pipe positioning member, having a relatively larger diameter at a receiving opening of the guiding path and a relatively smaller diameter at an opposite exit opening of the guiding path. The
receiving openings are directed away from each other, the opposite exit openings of the guiding paths with the relatively smaller diameter are facing each other. The relatively smaller diameter is at least equal to the diameter of the end part of the pipe section received in the pipe positioning member. The smaller diameter may be somewhat larger than the diameter of the end part of the pipe section, for instance 1% - 5% larger.

According to an embodiment, the first and second pipe positioning members both define a self-centring guiding path for guiding the respective first and second end parts to a nearby position, wherein the pipe connection device comprises a pressing system arranged for pressing the first and second end parts from the nearby position to an engaged position.

The first and second end parts are brought into (rough) alignment along the self-centring guiding paths. When the first and second end parts are (roughly) aligned within the first and second pipe positioning members, the end parts are pressed towards each other by a pressing system comprised in the device, such that the end parts engage each other and, when applicable, further align the end parts.

According to a further embodiment, the pressing system is arranged to press the first and second end parts while allowing the first and second end parts to further align with respect to each other. For instance, the pressing system may allow the first and second end parts, during pressing, to move laterally to align the first and second end parts with respect to each other. Also, rotational movements may be allowed to accomplish further alignment.

The pressing system may comprise a number of pressing elements, preferably at least two facing pressing elements, provided on end portions, for instance at the opposite exit openings, of the self-centring guiding paths that engage the end parts of the pipe sections and press the end parts towards each other, such that they engage each other. The end parts of the pipe sections may therefore be provided with engagement elements that can be engaged by the pressing elements. Preferably, the pressing system is provided with an actuator for pressing the first and second end parts from the nearby position to an engaged position.

According to another embodiment, each pipe positioning member comprises a first and a second positioning member part arranged to perform a relative movement with respect to each other between a closed position for receiving the first and second end parts and an open position for releasing the first and second end parts.
The first and second positioning member parts can be moved with respect to each other to a closed position, forming the self-centring guiding paths. When the pipe sections are connected through the coupled end parts, the end parts are released from the pipe positioning members by moving the first and second positioning member parts to an open position.

Preferably, the axial directions of the first and second pipe positioning member parts are mutually parallel and aligned in both the first and second position. The first and second pipe positioning member parts can be moved with respect to each other by a pivoting movement around a pivot axis, or by a linear movement.

According to a further embodiment, the pipe connection device comprising one or more further actuators for moving the first and second positioning member parts between the closed position and the open position. These actuators can be a mechanical or electrical engine or a hydraulic system. The actuators can actuate one of the pipe positioning member parts while keeping the other one stationary to assume the closed and/or the open position. Alternatively, the actuators can actuate both pipe positioning member parts to assume the closed and/or the open position.

Preferably, the first and second positioning member parts are hingeably connected to a hinge axis, whereby the first and second positioning member parts pivot about the hinge axis when being moved from the closed position to the open position.

According to another embodiment, the first positioning member parts of the first and second pipe positioning members are mounted in a first frame part and the second positioning member parts of the first and second pipe positioning members are mounted in a second frame part, wherein at least one of the first frame part and the second frame part are moveably connected to move between the closed and open position.

The first and second positioning member parts can be put into a respective frame part that supports and connects the first positioning member parts and the second positioning member parts to each other, respectively. The frame parts keep the first and second positioning member parts aligned with respect to each other, and additionally, keep the first and second positioning members aligned with respect to each other, irrespective of the position of the positioning member parts. The frame parts can be moved with respect to each other by a pivoting movement around a hinge axis, or can
be moved in a linear direction, for example a substantially vertical direction. The frame parts form a frame in the closed position.

According to a further embodiment, a gap is provided between the first and second pipe positioning members in at least the closed position in order to allow a connection member to pass between the pipe positioning members for joining connecting flanges provided at each extremity of each first and second pipe sections.

The gap refers to a distance in a direction of the central axis of the self-centring guiding paths.

The gap allows a connection member, such as a pair of coupling jaws, to be positioned over the connecting flanges of the end parts of the pipe sections. Preferably, in at least the closed position, the gap between the first and second pipe positioning members is formed by a mutual distance $D$, wherein $D$ is at least six times the thickness in an axial direction of a connecting flange at an end part of the pipe section.

Alternatively, $D$ is at least equal to a diameter of an adjacent end of the self-centring guiding path. Furthermore, $D$ can be defined by the distance between engagement elements provided at the end parts of the pipe sections. Preferably, the distance $D$ is at least 10 cm and preferably at most 1 meter.

According to a further embodiment, the device is provided with a pulling device for pulling the first and second end parts into the pipe positioning members and through the first and second self-centring guiding paths. The pulling device is used for pulling in the first and second end parts into the pipe positioning members. Upon receipt of the end parts into the respective pipe positioning members, the pulling device pulls the end parts through the self-centring guiding paths.

The invention further relates to a vessel comprising the pipe connection device as described above, whereby the device is mounted to the vessel, preferably with at least the first and second pipe positioning members at an outboard position.

To connect floating pipe lines in an offshore situation, the pipe connection device can be mounted on a vessel. The vessel can be a self-propellant vessel, like a ship, or a pontoon that is brought into position by another ship.

To facilitate the connection of the pipe sections afloat in the water, the first and second pipe positioning members are preferred to be in an outboard position. Preferably, the axial axes of the pipe positioning members are positioned outboard at the water line of the vessel, i.e. at the water surface. Thus, the pipe sections do not have
to be lifted from the water to be connected, or at least do not have to be lifted completely from the water to be connected. Alternatively, the pipe connection device can be moved up and down along the hull of the vessel, for instance when the water line of the vessel is heightened or lowered due to loading or unloading of freight. In addition, the axial axes pipe positioning members can be positioned at the real water line of the vessel and/or aligned with and at the same height as the axial axes of the pipe sections in the water, i.e. the pipe positioning members are not stationary with respect to the hull of the vessel.

According to an embodiment, the vessel comprises one or more further actuators as described above to actuate the first and second pipe connection member parts, wherein the actuators are connected with first ends to a hull of the vessel and connected with second opposite exit openings to the pipe positioning members.

The invention also relates to a pipe connection system for the coupling of pipe sections to form a pipeline, comprising:

- a plurality of pipe sections having first and second end parts comprising respective connection flanges and respective guiding elements adjacent to the connection flanges;

- a pipe connection device as described above, and

- an actuator device arranged to move the positioning member parts relative to each other to a closed position for forming the pipe positioning members and an open position to release the first and second end parts of the pipe sections.

The pipe connection system uses the pipe connection device as described above to connect pipe sections having connection flanges and guiding elements adjacent to the connection flanges. The pipe connection device as described above is used to align the pipe sections within the guiding paths, i.e. a rough alignment, of the pipe positioning members. The guiding elements at the end parts of the pipe sections align the pipe sections such that the connection flanges will abut each other upon connection, i.e. a refined alignment. An advantage of this refined alignment is that in case a seal or packing, such as an O-ring, is provided between the connection flanges for an improved fluid-tight connection, the seal or packing will not be damaged by large uncontrollable radial or axial movements of the end parts.
It may be that a pipe section with an end part as described and that is to be connected to a dredging vessel, will be connected in a different manner.

According to an embodiment, the first and second pipe positioning members both define a self-centring guiding path for guiding the respective first and second end parts to a nearby position, wherein the guiding elements of the nearby end parts are within each other's reach,

wherein the pipe connection device comprises a pressing system arranged for pressing the first and second end parts from the nearby position to an engaged position.

The guiding elements are within each other's reach once there is overlap in longitudinal direction.

The self-centring guiding paths guide the first and second end parts to a position in which they are close to each other, but are not yet connected. The guiding elements of the end parts are not yet engaging each other. The pressing system presses the end parts from being close to each other to engaging each other, while the guiding elements guide the end parts along the path from the nearby position, i.e. being close, to the engaging position. In the engaging position, the connection flanges abut each other and are aligned with respect to each other in a coaxial manner. A seal or packing, such as an O-ring, may be provided between the connection flanges in the engaging position. The seal or packing can be provided before or during positioning in the positioning member parts or alignment in the self-centring guiding paths.

According to a further embodiment, the guiding elements at the first end part comprises a lead portion and the guiding element at the second end part comprises a receiving portion to receive the lead portion of the first end part.

The guiding elements adjacent the connection flanges are used to guide and centre the end parts with respect to each other. This takes care of the final fine alignment. Upon moving the end parts of the two pipe sections towards each other, a protruding end of the lead portion of one guiding element is received by the receiving portion of another guiding element. The lead portion and the receiving portion are preferred to have matching shapes, more preferably engaging shapes, such that the end parts of the two pipe sections engage each other upon connection.

According to another embodiment, the system comprises a plurality of coupling collars, each sized to engage a pair of connection flanges of two pipe sections placed in alignment. The pipe sections are preferably connected by a coupling collar that can
engage the abutting connection flanges after alignment of the pipe sections by both the pipe positioning members and the guiding element adjacent the connection flanges. Additionally, the connection flanges can be connected by bolts and/or nuts.

Alternatively, the invention relates to a pipe section having a first and a second end part, wherein each end part is provided with a connection flange at its end and a guiding element adjacent to the connection flange, whereby the guiding element at the first end part comprises a lead portion and the guiding element at the second end part comprises a receiving portion to receive the lead portion of the first end part. The pipe section can be a relatively rigid pipe or a relatively flexible pipe, such as a hose. The guiding elements are at the extremities of the pipe sections.

Preferably, the connection flange comprises a facing side facing the end part of the pipe section and a rear side facing away from the facing side, the rear side having a tapered surface for pressing the connection flanges towards each other upon connection of the pipe sections. The tapered surfaces allow radial forces exerted on the connection flanges to press the connection flanges towards each other in an axial direction. This ensures a fluid-tight connection between the end parts.

Preferably, the tapered surface of the rear side and the facing side are at an angle with each other between 10° to 30°.

According to another embodiment, the end parts are provided with engagement elements positioned at a distance from the connection flange and positioned behind the connection flange viewed from the extremity of the end part, forming engagement elements for applying a pressing force to press the pipe section in a direction towards the respective end parts. The engagement elements can be engaged by the pressing system of the pipe positioning device upon alignment of the pipe sections by the self-centring guiding paths.

According to a further embodiment, centring elements can be provided at the opposite exit opening to keep the end part centred with respect to the guiding path and aligned with respect to the other end part. The centring elements can be in contact with at least part the circumference of the engagement element, but this is not necessary for centring the end parts with respect to each other. The circumference of the engagement element can be in contact with the centring elements to further limit the freedom of movement in the radial direction of the end part. However, a tight fit between the
engagement element and the centring elements is not preferred, such that the end parts can still be moved in an axial direction by the pressing elements.

Furthermore, the invention relates to a method for coupling dredging pipe sections to form a pipeline, comprising:

a) providing a pipe connection device as described above,

b) providing a first pipe section and a second pipe section as described above,

c) positioning the end part of the first pipe section into the first pipe positioning member,

d) positioning the end part of the second pipe section into the second pipe positioning member,

e) guiding the first and second pipe sections towards each other along the respective self-centring guiding paths.

The pipe sections as described above move with the wind, waves and water current in off shore situations. The pipe positioning members position the end parts of the respective pipe sections in a roughly aligned position, such that the connection flanges at the ends of the end parts can be connected with each other. The alignment is achieved by guiding the end parts of the pipe sections towards each other along self-centring guiding paths. Along these guiding paths, the end parts become more and more aligned with respect to each other, i.e. the deviation in the respective positions in a radial direction becomes smaller along the guiding paths.

According to an embodiment, step e) comprises

el) guiding the first and second pipe sections towards each other along the respective self-centring guiding paths to a nearby position,

e2) pressing the first and second end parts from the nearby position to an engaged position.

The guiding paths have a receiving opening where the end parts are received in the guiding paths, and an opposite exit opening, where the end parts, upon reaching this opposite exit opening, are in a nearby position. At the opposite exit openings, the connection flanges do not yet abut, but are nearby each other. The end parts are then pressed towards each other until the connection flanges abut and the end parts are in the engaged position. Pressing may be done with a pressing system that interacts with engagement elements provided on the pipe sections.
According to a further embodiment, each pipe positioning member comprises a first and a second positioning member part arranged to perform a relative movement with respect to each other between a closed position for receiving the first and second end parts and an open position for releasing the first and second end parts and a) positioning the first and second positioning member parts in the closed position.

The self-centring guiding paths guiding and aligning the end parts are formed by the pipe positioning member parts in a closed position.

According to another embodiment, the method comprises f) connecting the respective end parts of the first and second pipe sections to each other, for instance by connecting the end parts by a connection member catching connection flanges provided at ends of the end parts of each pipe section.

After alignment of the end parts and the respective connection flanges with respect to each other, the connection flanges are connected to each other by connection member, such as a pair of coupling collars or bolts and/or nuts.

According to another embodiment, each pipe positioning member comprises a first and a second positioning member part arranged to perform a relative movement with respect to each other between a closed position for receiving the first and second end parts and an open position for releasing the first and second end parts and the method comprises g) releasing the first and second pipe sections by positioning the first and second positioning member parts in the open position.

Upon connection of the connection flanges, the pipe sections form a pipe system or pipeline. The pipe system is released from the pipe connection device by opening the pipe positioning members. The pipe positioning member parts are then moved from the closed position to the open position.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the invention will be appreciated upon reference to the following drawings of a number of exemplary embodiments, in which:

Figure 1 shows a perspective view of a pipe connection system comprising a pipe positioning device and a plurality of pipe sections;
Figure 2 shows a perspective view of one of the pipe sections positioned in the pipe positioning device;

Figure 3 shows a perspective view of two pipe sections positioned in the pipe positioning device;

Figure 4 shows a front view of the two pipe sections positioned in the pipe positioning device shown in figure 3;

Figure 5 shows a perspective view of two connected pipe sections positioned in the pipe positioning device

Figure 6 shows a perspective view of the pipe positioning device in an open position, releasing two connected pipe sections.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

Figure 1 shows a perspective view of a pipe connection system 1 comprising a pipe positioning device 3 and a plurality of pipe sections 2, 2’. The pipe sections 2, 2’ each have an end part 4, 4’. The end part 4, 4’ has a connection flange 14 at its end. Adjacent the connection flange 14 at the extremity of the end part 4, 4’, a guiding element 15 is provided at the end part. The end part 4, 4’ further has engagement elements 13 at a distance from the connection flange 14, which engagement elements 13 are positioned behind the connection flange 14 viewed from the guiding element 15 at the extremity of the end part 4, 4’. The engagement element 13 is provided with openings 17 along the circumference of the engagement element 13. In addition, the end part 4, 4’ is provided with protrusions 16 aligned with openings 17 in the engagement elements 13. The protrusions 16 form a through hole 23. The openings 17 and through holes 23 can be used to connect the pipe sections to each other.

The pipe positioning device 3 comprises a frame 11 formed of a first frame part 9 and a second frame part 10. Within the frame, pipe positioning members 5, 5’ for each respective end part 4, 4’ is provided. The pipe positioning member 5, 5’ comprises a self-centring guiding path 6 for guiding the end part 4, 4’ into the pipe positioning member 5, 5’. The self-centring guiding path 6 has a receiving opening 21 in which the end part 4, 4’ of the pipe section 2, 2’ is received in to the guiding path 6. After being guided through the guiding path 6, the end part 4, 4’ exits the guiding path 6 at an opposite exit opening 22 opposite to the receiving opening 21. At the opposite exit opening 22 centring elements 19 can be provided around the circumference of the
opposite exit opening 22 to keep the end part 4, 4' centred with respect to the guiding path 6.

In addition, at the opposite exit opening 22 a pressing system is provided, comprising pressing elements 12 at several locations along the circumference of the guiding path 6. Figure 1 shows the pressing elements 12 located at two opposite locations, but more than two locations can be possible as well.

The pipe positioning members 5, 5' each comprise a first pipe positioning member part 7 and a second pipe positioning member part 8. The pipe positioning members 5, 5' are coaxially positioned with respect to each other within the frame 11. The first pipe positioning member 7 is provided in the first frame part 9 and the second pipe positioning member 8 is provided in the second frame part 10. The first and second frame parts 9, 10 and the respective pipe positioning member parts 7, 8 can be moved with respect to each other by means of hinges 20 from a closed position (shown in figure 1) to an open position (see figure 6). Both frame parts with the respective pipe positioning member part can be pivoted around the hinge 20, but alternatively, one of the frame parts can be kept stationary while the other frame part is pivoted around the hinge 20.

Figure 2 shows a perspective view of one of the pipe sections 2, 2' positioned in the pipe positioning device 3. The pipe sections 2, 2' are pulled into the respective self-centring guiding path 6 in sequence or one at a time by a pulling device (not shown). The pulling device may for instance comprise a winch and a rope or chain. The chain may run through the self-centring guiding path and can be attached to the pipe section.

The end part 4, 4' follows the self-centring guiding path 6 of the pipe positioning member 5, 5' from the receiving opening 21 to the opposite opposite exit opening 22 of the guiding path 6. At the opposite exit opening 22 centring elements 19 are provided to keep the end part 4, 4' centred with respect to the guiding path 6 and aligned with respect to the other end part 4, 4'. The centring elements 19 can be in contact with at least part the circumference of the engagement element 13, but this is not necessary for centring the end parts 4, 4' with respect to each other. Upon reaching the opposite exit opening 22 of the guiding path 6, the pressing elements 12 of the pressing system engage the engagement element 13 at the circumference, such that the end parts 4, 4' can be pressed towards each other until the connection flanges 14 abut. The pressing system can be actuated by actuators (not shown) to move the pressing elements 12 into
a pressing movement. This is preferred for pipe sections 2, 2' that are already part of pipe systems of a plurality of pipe sections.

Figure 3 shows a perspective view of two pipe sections 2, 2' positioned in the pipe positioning device 3. After positioning the pipe sections 2, 2' in the respective pipe positioning members 5, 5', the end part 4, 4' will be guided along the self-centring guiding path 6 to a position in which the connection flanges 14 of the respective end parts 4, 4' are in a nearby position, i.e. between the connection flanges a gap with a distance of at least the width of the guiding element 15, shown in fig. 1, is maintained. In this nearby position, the pressing elements 12 engage the end parts 4, 4' at the circumference of the engagement elements 13. The pipe sections 2, 2' remain centred with respect to the pipe positioning members due to the centring elements 19. Actuators are provided (not shown) to actuate the pressing elements 12 to move the end parts 4, 4' in an engaging position, i.e. in a position where the connection flanges 14 abut.

During movement of the end parts 4, 4' towards each other from the nearby position to the engaging position, the guiding element 15 at the extremity of the end part 4, 4' adjacent to the connection flanges 14 will further align the end parts 4, 4' with respect to each other. The guiding element 15 comprises a lead portion that extends outwardly from the connection flange of a first end part and a receiving portion that extends inwardly from the connection flange 14 of a second end part. The lead portion and the receiving portion preferably have matching shapes, more preferably conically shaped for self-centring, as shown in fig. 1. Upon pressing of the pressing elements 12, the lead portion of the guiding element 15 will be received by the receiving portion. As the lead portion and the receiving portion are shaped to be self-centring in addition to the self-centring guiding path 6, the end parts 4, 4' will be further aligned with each other upon movement from the nearby position to the engaging position.

Figure 4 shows a front view of the two pipe sections 2, 2' positioned in the pipe positioning device 3 as shown in figure 3. The pipe positioning members are shaped as funnel-like cones that have a relatively larger diameter at the receiving opening 21 (shown in fig. 1-3) and a relatively smaller diameter at the opposite exit opening 22 of the self-centring guiding path 6. Due to the conical or funnel-like shape of the guiding path 6, the freedom of movement in a radial direction of the end parts 4, 4' decreases along the self-centring guiding path 6. The engagement element 13 is used to keep the
end part 4, 4' centred after passing of the end part 4, 4' through the exit opening 22.
The circumference of the engagement element 13 can be in contact with the centring elements 19 to further limit the freedom of movement in the radial direction of the end part 4, 4'. However, the engagement element 13 and the centring elements 19 should not have tight fit, such that the end parts 4, 4' can still be moved in an axial direction by the pressing elements 12.

The connection flanges 14 in fig. 4, 4' have facing sides 25 that face each other while connected or in the pipe positioning members, and rear sides 24 that face away from each other and from the respective facing side 25 of the respective end part 4, 4'. The rear side 24 has a tapered surface that includes an angle between 10° to 30° with the respective facing side 25. Such a tapered connection flange 14 is advantageous when using coupling collars 18 to connect the pipe sections, as shown in Figure 5.

Alternatively, the connection flange 14 may be provided with a plurality of through holes that can be aligned with the through holes of a facing connection flange 14. A connection element such as a bolt and a nut can then be inserted in these through holes to connect the connection flanges. Another alternative is to use the through holes 23 in the protrusions 16 to connect the connection flanges 14 after centring and alignment.

To allow connection of the connection flanges 14, a gap is provided between the pipe positioning members 5, 5'. This gap defines a distance D between the opposite exit openings 22 of the self-centring guiding paths 6. Preferably, this distance is at least six times the axial width of the connection flange 14 to allow access to the through holes by a bolt. Figure 5 shows that the distance between the centring elements 19, being part of the pipe positioning members, is defined by the distance between the engagement elements 13. The gap also allows a pair of coupling collars 18 to pass through, such that the jaws of such coupling collars 18 can engage and connect the connection flanges 14.

Figure 6 shows a perspective view of the pipe positioning device in an open position, releasing two connected pipe sections. After connection of the connection flanges 14 with the coupling collars 18, the pipe sections 2, 2' form a pipe system in the pipe connection device. To release the pipe system from the pipe connection device, the first frame part 9 with the first pipe positioning members 7 and the second frame part 10 with the second pipe positioning members 8 are pivoted with respect to each other.
around hinge 20 from the closed position shown in figs. 1-4 to the open position shown in fig. 6. The pipe system can then be moved out of the pipe connection device 1 onto the water surface in an off shore situation to become a floating pipe system.
LIST OF PARTS

1. Pipe connection system
2+2'. Pipe section
5 3. Pipe positioning device
4+4'. End part
5+5'. Pipe positioning member
6. Self-centring guiding path
7. First pipe positioning member part
10 8. Second pipe positioning member part
9. First frame part
10. Second frame part
11. Frame
12. Pressing element
15 13. Engagement element
14. Connection flange
15. Guiding element
16. Protrusion
17. Opening
20 18. Coupling collar
19. Centring element
20. Hinge
21. Receiving opening of guiding path
22. Opposite exit opening of guiding path
25 23. Through hole
24. Rear side of connection flange
25. Facing side of connection flange
1. A pipe connection device (3) for coupling a first end part (4) of a first pipe section (2) to a second end part (4') of a second pipe section (2') to form a pipeline, wherein the device comprises:
   - a first pipe positioning member (5) arranged to receive the first end part,
   - a second pipe positioning member (5') arranged to receive the second end part,
   wherein the first and second pipe positioning members both define a self-centring guiding path (6) formed by a funnel-like shaped pipe positioning member for guiding the respective first and second end parts towards each other,
   wherein the first and second pipe positioning members are mounted with the first and second self-centring guiding paths coaxial with respect to each other.

2. A pipe connection device according to claim 1, wherein the first and second pipe positioning members both define a self-centring guiding path for guiding the respective first and second end parts to a nearby position,
   wherein the pipe connection device comprises a pressing system arranged for pressing the first and second end parts from the nearby position to an engaged position.

3. A pipe connection device according to claim 2, wherein the pressing system is arranged to press the first and second end parts while allowing the first and second end parts to further align with respect to each other.

4. A pipe connection device according to claim 2 or 3, wherein the pressing system is provided with an actuator for pressing the first and second end parts from the nearby position to an engaged position.

5. A pipe connection device according to any one of the preceding claims, wherein each pipe positioning member comprises a first and a second positioning member part (7, 8) arranged to perform a relative movement with respect to each other between a closed position for receiving the first and second end parts and an open position for releasing the first and second end parts.
6. A pipe connection device according to claim 5, wherein the axial directions of the first and second pipe positioning member parts are mutually parallel and aligned in both the open and closed position.

7. A pipe connection device according to any one of the claims 5 - 6, the pipe connection device comprising one or more further actuators for moving the first and second positioning member parts between the closed position and the open position.

8. A pipe connection device according to any one of the claims 5 - 7, wherein the first and second positioning member parts are hingeably connected to a hinge axis, whereby the first and second positioning member parts rotate about the hinge axis when being moved from the closed position to the open position.

9. A pipe connection device according to any one of the claims 5 - 8, wherein the first positioning member parts (7) of the first and second pipe positioning members are mounted in a first frame part (9) and the second positioning member parts (8) of the first and second pipe positioning members are mounted in a second frame part (10), wherein at least one of the first frame part and the second frame part are moveably connected to move between the closed and open position.

10. A pipe connection device according to any of the preceding claims, wherein a gap is provided between the first and second pipe positioning members in at least the closed position in order to allow a connection member (18) to pass between the pipe positioning members for joining connecting flanges (14) provided at each extremity of each first and second pipe sections.

11. A pipe connection device according to claim 10, wherein, in at least the closed position, the first and second pipe positioning members are at a mutual distance D, wherein D is defined by the distance between the respective engagement elements of each pipe section, wherein D at least 10 cm and preferably at most 1 meter.

12. A pipe connection device according to any one of the preceding claims, whereby the device is provided with a pulling device for pulling the first and second end parts
into the pipe positioning members and through the first and second self-centring
guiding paths.

13. A vessel comprising the pipe connection device (1) according to any of the
preceeding claims, whereby the device is mounted to the vessel, preferably with at least
the first and second pipe positioning members (5, 5') at an outboard position.

14. Vessel according to claim 13, comprising one or more further actuators according
to claim 6, wherein the actuators are connected with first ends to a hull of the vessel
and connected with second opposite end parts to the pipe positioning members.

15. A pipe connection system (1) for the coupling of pipe sections (2, 2') to form a
pipeline, comprising:
   - a plurality of pipe sections (2, 2') having first and second end parts (4, 4')
   - a pipe connection device (3) according to any one of the claims 1 - 12, and
     an actuator device arranged to move the positioning member parts relative to
each other to a closed position for forming the pipe positioning members (5, 5') and an
open position to release the first and second end parts of the pipe sections.

16. A pipe connection system according to claim 15, wherein the first and second
pipe positioning members both define a self-centring guiding path (6) for guiding the
respective first and second end parts to a nearby position, wherein the guiding elements
of the nearby end parts are within each other's reach,

   wherein the pipe connection device comprises a pressing system arranged for
pressing the first and second end parts from the nearby position to an engaged position.

17. A pipe connection system according to claim 16, wherein the guiding elements at
the first end part comprises a lead portion and the guiding element at the second end
part comprises a receiving portion to receive the lead portion of the first end part.
18. A pipe connection system according to any one of the claims 16 - 17, wherein the pressing system is arranged to press the first and second end parts while allowing the first and second end parts to further align with respect to each other.

19. A pipe connection system according to any one of the claims 15 - 18, wherein each pipe positioning member comprises a first and a second positioning member part (7, 8) arranged to perform a relative movement with respect to each other between a closed position for receiving the first and second end parts and an open position for releasing the first and second end parts.

20. A pipe connection system according to claim 19, wherein the first positioning member parts (7) of the first and second pipe positioning members are mounted in a first frame part (9) and the second positioning member parts (8) of the first and second pipe positioning members are mounted in a second frame part (10), wherein at least one of the first frame part and the second frame part are moveably connected to move between the closed and open position.

21. A pipe connection system according to any of claims 15 - 20, comprising a plurality of coupling collars (18), each sized to engage a pair of connection flanges (14) of two pipe sections placed in alignment.

22. Pipe section having a first and a second end part (4, 4'), wherein each end part is provided with a connection flange (14) at its end and a guiding element (15) adjacent to the connection flange, whereby the guiding element at the first end part (4) comprises a lead portion and the guiding element at the second end part (4') comprises a receiving portion to receive a lead portion of a first end part of a similar pipe section.

23. Pipe section according to claim 22, wherein the connection flange comprises a facing side (25) facing the end part of the pipe section and a rear side (24) facing away from the facing side, the rear side having a tapered surface for pressing the connection flanges towards each other upon connection of the pipe sections.
24. Pipe section according to claim 23, wherein the tapered surface of the rear side and the facing side are at an angle with each other between 10° to 30°.

25. Pipe section according to any one of the claims 22 - 24, wherein the end parts are provided with engagement elements (13) positioned at a distance from the connection flange for engaging by the pressing system for applying a pressing force to press the floating pipe section in a direction towards each other.

26. Method for coupling dredging pipe sections (2, 2') to form a pipeline, comprising:
   a) providing a pipe connection device (3) according to any one of the claims 1 -
   12,
   b) providing a first pipe section (2) and a second pipe section (2'),
   c) positioning the end part (4) of the first pipe section into the first pipe positioning member (5),
   d) positioning the end part (4') of the second pipe section into the second pipe positioning member (5'),
   e) guiding the first and second pipe sections towards each other along the respective self-centring guiding paths (6) formed by funnel-like shaped pipe positioning members.

27. Method according to claim 26, wherein e) comprises
   e1) guiding the first and second pipe sections towards each other along the respective self-centring guiding paths to a nearby position,
   e2) pressing the first and second end parts from the nearby position to an engaged position.

28. Method according to any one of the claims 26 - 27, wherein each pipe positioning member comprises a first and a second positioning member part (7, 8) arranged to perform a relative movement with respect to each other between a closed position for receiving the first and second end parts and an open position for releasing the first and second end parts and a) comprises
al) positioning the first and second positioning member parts in the closed position.

29. Method according to any one of the claims 26 - 28, wherein the method comprises
f) connecting the respective end parts of the first and second pipe sections to each other, for instance by connecting the end parts by a connection member (18) catching connection flanges (14) provided at ends of the end parts of each pipe section.

30. Method according to any one of the claims 26 - 29, wherein each pipe positioning member comprises a first and a second positioning member part arranged to perform a relative movement with respect to each other between a closed position for receiving the first and second end parts and an open position for releasing the first and second end parts and the method comprises
g) releasing the first and second pipe sections by positioning the first and second positioning member parts in the open position.
Fig. 4
**INTERNATIONAL SEARCH REPORT**

**International application No**
PCT/NL2014/05Q267

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. F16L1/09 E02F7/02 E02F7/10 F16L1/10 F16L1/26

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 E02F

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

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

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) on which the invention is based or on other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "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
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- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is considered in combination with one or more other such documents, such combination being obvious to a person skilled in the art
- "Z" document member of the same patent family

Date of the actual completion of the international search Date of mailing of the international search report

3 July 2014 14/07/2014

Name and mailing address of the ISA/Authorized officer

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Vecchio, Giovanni
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This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claims Nos.:
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. □ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. X As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. □ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

□ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

□ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

□ No protest accompanied the payment of additional search fees.
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-30

Claims 1-21 and 26-30 define a pipe connection device and a method for coupling dredging pipe sections by providing such a pipe connection device.

1.1. claims: 22-25

Claims 22-25 define a pipe section having specifically shaped flanges
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