In this case, the fixing module would be equipped with two winches of type 47 or with one winch having two drums.

In the prior art, the pull-in wire is connected to the flexible pipe in such a fashion that the pull-in direction is more or less aligned with the longitudinal axis of the flexible pipe. The weight of the hose end assembly may create a significant deviation in angle between pulling rope and hose and eventually guide system. This may create problems at initial entering in the funnel. The slits which are present in the prior art coupling devices also represent a potential operational hazard or limitation, as the pull-in wire may be jammed into the slits, causing equipment damage and interruption of operations.

The present applicant has devised and embodied this invention to overcome the shortcomings and to obtain further advantages.

Summary of the invention

The invention is set forth and characterized in the main claim, while the dependent claims describe other characteristics of the invention.

The invention provides a coupling device for connecting a first coupling housing and a second coupling housing, characterized in that the first coupling housing comprises a guiding element extending from the first coupling housing and having a free end at a distance from the first coupling housing central axis at least a portion of the guiding element having a non-circular cross-section, the second coupling housing comprises a receptacle for the guiding element and pull-in means for pulling the guiding element into the receptacle, said pull-in means being connected to the guiding element free end, at least a portion of the receptacle having a non-circular cross-section of a shape which is complementary with the guiding element non-circular portion, whereby the first coupling housing is moved (e.g. pulled towards) the receptacle at an angle which is not coincident with the central axis, and when the guiding element is in place inside the receptacle, the first coupling housing central axis and the central axis of the second coupling housing are aligned and coincident, and the two housings are rotationally aligned.

In one embodiment, the guiding element head comprises a ball shape and a guiding element base portion having a substantially rectangular and slender cross-section, its long side extending along said axis.

In one embodiment, the receptacle comprises a rectangular bell-mouth shape.

In one embodiment, the cross-sectional shapes of the guiding element and the receptacle are non-circular, i.e. mainly rectangular, oblong, oval, triangular, etc., which provides sideways, longitudinal and rotational righting moments for the first coupling housing.

The pulling force exerted by the pull-in means is in a direction which is steeper than the first coupling housing central axis.

Claims

1. A coupling device, **characterized by**
- a first coupling housing ~~(12)~~ comprising a guiding element ~~(101; 201; 301a-c; 401b,c; 501b-d)~~ extending from the first coupling housing ~~(12)~~ and having a free end ~~(102; 202; P)~~ at a distance ~~(h)~~ from the first coupling housing central axis ~~(a-a)~~, at least a portion of the guiding element having a non-circular cross-section; and
- a second coupling housing ~~(20)~~ comprising a receptacle ~~(123; 223; 323; 423; 523)~~ for guiding element and pull-in means ~~(8)~~ for pulling the guiding element into the receptacle, said pull-in means ~~(8)~~ being connected to the guiding element free end ~~(102; 202; P)~~, at least a portion of the receptacle having a non-circular cross-section of a shape which is complementary with the guiding element non-circular portion, such that the movement of the first coupling housing towards the receptacle is at an angle which is not coincident with the central axis ~~(a-a)~~, and – when the guiding element is in place inside the receptacle - , the first coupling housing central axis ~~(a-a)~~ and the central axis ~~(b-b)~~ of the second coupling housing are aligned and coincident, and the two housings are rotationally aligned.

2. The coupling device of claim 1, wherein the guiding element free end ~~(102; 202)~~ comprises a ball shape and a guiding element base portion ~~(105; 205)~~ having a substantially rectangular and slender cross-section, its long side extending along said axis ~~(a-a)~~.

3. The coupling device of claim 1 or 2, wherein the receptacle ~~(223)~~ comprises a rectangular bell-mouth shape.

4. The coupling device of any one of the preceding claims, wherein the non-circular cross-sections comprise rectangular, oblong, oval, triangular, etc., whereby sideways, longitudinal and rotational righting moments for the first coupling housing ~~(12)~~ are provided.

5. The coupling device of any one of the preceding claims, wherein the pulling force exerted by the pull-in means ~~(8)~~ is in a direction which is steeper than the first coupling housing ~~(12)~~ central axis.

6. The coupling device of any one of the preceding claims, wherein at least a portion ~~(103)~~ of the guiding element ~~(101)~~ is movably supported by support elements ~~128a,b~~ of the receptacle, said portion and elements being shaped such that the first coupling housing ~~(12)~~ is movable with respect to the second coupling housing ~~(20)~~ while the first coupling housing central axis ~~(a-a)~~ and the second coupling housing central axis ~~(b-b)~~ are substantially coincident and/or parallel.

7. The coupling device of claim 6, wherein said portion ~~(103)~~ comprises a face which is aligned substantially parallel with said axes.

8. The coupling device of any one of the preceding claims, wherein the receptacle ~~(123)~~ is arranged in a docking frame ~~(122)~~, and slidable in the docking frame ~~(122)~~ between an extended position in which the guiding element may be pulled into the receptacle, and a retracted position in which the first coupling housing ~~(12)~~ and the second coupling housing ~~(20)~~ are connected.

9. The coupling device of claim 8, wherein the guiding element is locked in the receptacle prior to retracting to the position in which the first coupling housing ~~(12)~~ and the second coupling housing ~~(20)~~ are connected.

10. The coupling device of any one of the preceding claims, wherein the first coupling housing ~~(12)~~ is connected to a flexible pipe ~~(5)~~ for transfer of LNG or evaporated LNG and the second coupling housing ~~(20)~~ is connected to a pipe ~~(25)~~ on a vessel ~~(2)~~, for transferring LNG or evaporated LNG between the flexible pipe ~~(5)~~ and a storage tank on the vessel ~~(2)~~.