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**US-A-4 019 213
US-A-4 301 840**

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Description

The invention relates to a mooring system comprising a turret having a rotatable part and a stationary part anchored to the seabed, and to which is connected an end of a flexible flowline which flowline is also connected to an underwater buoyant body substantially freely movable relative to the turret and anchored to the seabed.

Such a mooring system is known in itself from US—A—4301840.

To allow for movements of the vessel, which can be a tanker used for the storage of crude oil and even provided with production facilities on its deck, or a large barge, depending on the occurrence of waves, currents and winds, the vessel can rotate through an angle of 360° with regard to the stationary second part of the mooring system. A swivel coupling at the upper part of this stationary part allows for the transfer of fluids from the flexible flowline up to the vessel deck.

The flexible flowline, however, must be kept within the periphery of the anchor chains or anchor cables with which the second part of the mooring is anchored to the seabed. In deep water these anchor chains or cables hang relatively steeply from the stationary part, for instance under an angle of 25° with the vertical. To prevent chafing and subsequent damage of the flowline it must be assured that the flowline stays within the space delimited by the anchor chains, with the result that the buoyant body must be a considerable distance below the surface of the water. As, however, the section of the flexible pipe between the stationary member and the buoyant body is dynamically loaded, due to vessel movement, this part needs regular checking and maintenance which, in view of the deep level at which the buoyant body is positioned, is a difficult and expensive task.

The invention aims to provide an alternative arrangement of the submerged flowline layout which obviates the disadvantages of the known layout. According to the invention, the stationary part carries an outrigger to which said end of the flowline between the buoyant body and the stationary end is connected. This simple measure makes it possible to locate the dynamic portion of the flowline outside the periphery of the anchor chains, eliminating any possibility of chafing or physical contact between the anchor chains and the flexible pipe, and greatly facilitating maintenance of this dynamically loaded flowline part.

To obtain an equal loading of the stationary part, the latter preferably carries more than one outrigger.

According to the invention, the buoyant body is preferably positioned at a short distance under the keel of a moored vessel, which of course greatly facilitates its maintenance. As the part of the flowline between the buoyant body and the floor shows very little dynamic motion, maintenance or repair of this part is practically nil.

Furthermore each outrigger can be individually connected by one or more chains to the buoyant body.

It is observed that US—A—4019213 describes the combination of a mooring tower and an underwater buoyant body; in the one disclosed embodiment (fig. 2) the buoyant body is carried at the end of a pivoting outrigger connected to the tower while in the second disclosed embodiment (fig. 1) the buoyant body is substantially freely movable with respect to the mooring turret and serves to keep the flowline taut. This latter arrangement has all the disadvantages of the known mooring system.

The invention will be elucidated on the face of the drawings in which:

Fig. 1 shows a schematic side view of the mooring system according to the invention;

Fig. 2 shows a detail of Fig. 1 on a much enlarged scale;

Fig. 3 shows a top view of the stationary part of the mooring; and

Fig. 4 is a view of this part on a much enlarged scale.

The vessel 1 is fitted to the rotatable part 2 of the turret mooring 4 which in the shown embodiment is integrated with the bow 3 of the vessel 1. The stationary part 5 is interconnected with the rotatable part 2 in a basically vertical direction so that the vessel 1 can swing around the centre axis of the stationary part 5 to take the position of least resistance due to weather.

To the stationary part 5 are connected the anchor chains 6 and the flexible flowline 7. The flexible flowline 7 is connected to the stationary part 5 via an outrigger 8. The length of the outrigger 8 is such that the flexible flowline remains clear of touching the anchor chains 6 in all circumstances. Thereto the flexible flowline 7 is connected to the buoyant body 10 and the configuration of the flexible flowline 7 is a catenary shape.

The buoyant body 10 is anchored to an anchor on the seafloor 12 via a taut mooring line 14. The vertical position of the buoyancy tank 10 is just below the keel of the vessel 1 so that it can freely rotate over this buoyant body 10. The flexible flowline 7 continues from the buoyant body 10 down to the seafloor 12 via a free-hanging section 16. At the outrigger 8 the flowline 7 continues with a rigid pipe 18 to the stationary part 5 up to deck level of the vessel 1. In order to allow the fluid to flow continuously to the vessel 1 a swivel joint 20 is incorporated in the rigid pipe 18.

In Fig. 3 the top view shows again the vessel 1, the anchor chains 6, the stationary part 5, the rotatable part 2 and the outrigger 8. The outrigger 8 could be extended into a triangular frame 9 so that between the outrigger 8 and the buoyant body 10 a certain offset can be obtained so that the flowline 7 can be maintained and lifted over the side of the vessel 1 in the particular heading of that vessel 1. To that extent, one or more tension chains 11 are fitted between the triangular part of the outrigger 9 and the buoyant body 10.

Fig. 4 in more detail shows a typical configuration of the outrigger 8, the triangular frame 9, the flexible flowlines 7, the rigid pipe 18 and the angle

chains 6 which are supported by the stationary part 5 via chain stoppers 15. Also shown are the tension chains 11, the number and weight of which are dependent on the size, weight and number of flowlines 7.

An alternative design for more flowlines could comprise two or more outriggers to the stationary part, positioned such that an equilibrium is obtained.

Claims

1. Mooring system comprising a turret (4) having a rotatable part (2) and a stationary part (5) anchored to the seabed (12) and to which is connected an end of a flexible flowline (7), which flowline is also connected to an underwater buoyant body (10) substantially freely movable relative to the turret and anchored to the seabed, characterised in that the stationary part (5) carries an outrigger (8) to which the said end of the flowline (7) between the buoyant body (10) and the stationary part (5) is connected.

2. Mooring system according to claim 1, characterised in that the stationary part (5) carries more than one outrigger (8).

3. Mooring system according to claim 1 or 2, characterised in that the buoyant body (10) is positioned a short distance below the keel of a moored vessel.

4. Mooring system according to claim 1—3, characterised in that each outrigger (8) is individually connected by one or more chains (11) to the buoyant body (10).

Patentansprüche

1. Vertäuerankersystem umfassend einen Drehturm (4) mit einem Drehteil (2) und einem ortsfesten Teil (5), welcher am Meeresboden (12) verankert und mit einem Ende einer flexiblen Zuleitung (7) verbunden ist, welche mit einem Unterwasserschwimmkörper (10) verbunden und im wesent-

lichen frei relativ zu dem Drehturm beweglich und am Meeresgrund verankert ist, dadurch gekennzeichnet, daß das ortsfeste Teil (5) einen Ausleger (8) trägt, mit welchem das Ende der Zuleitung (7) zwischen dem Schwimmkörper (10) und dem ortsfesten Teil (5) verbunden ist.

2. Vertäuerankersystem nach Anspruch 1, dadurch gekennzeichnet, daß das ortsfeste Teil (5) mehr als einen Ausleger (8) trägt.

3. Vertäuerankersystem nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Schwimmkörper (10) ein kurzes Stück unterhalb des Kiels eines vertäuten Schiffes angeordnet ist.

4. Vertäuerankersystem nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß jeder Ausleger (8) einzeln mittels einer oder mehrerer Ketten (11) mit dem Schwimmkörper (10) verbunden ist.

Revendications

1. Système d'amarrage comprenant une tourelle (4) ayant une partie tournante (2) et une partie fixe (5) ancrée au fond de la mer (12) à laquelle est relié un bout d'une conduite flexible (7), laquelle est également reliée à un corps flottant sous-marin (10) pratiquement libre de se déplacer par rapport à la tourelle et ancré au fond de la mer, caractérisé en ce que la partie fixe (5) porte un balancier (8) auquel ledit bout de la conduite (7), entre le corps flottant (10) et la partie fixe (5), est relié.

2. Système d'amarrage selon la revendication 1, caractérisé en ce que la partie fixe (5) porte plus d'un balancier (8).

3. Système d'amarrage selon la revendication 1 ou 2, caractérisé en ce que le corps flottant (10) est placé à courte distance sous la quille du navire amarré.

4. Système d'amarrage selon l'une des revendications 1 à 3, caractérisé en ce que chaque balancier (8) est individuellement relié par une ou plusieurs chaînes (11) au corps flottant (10).

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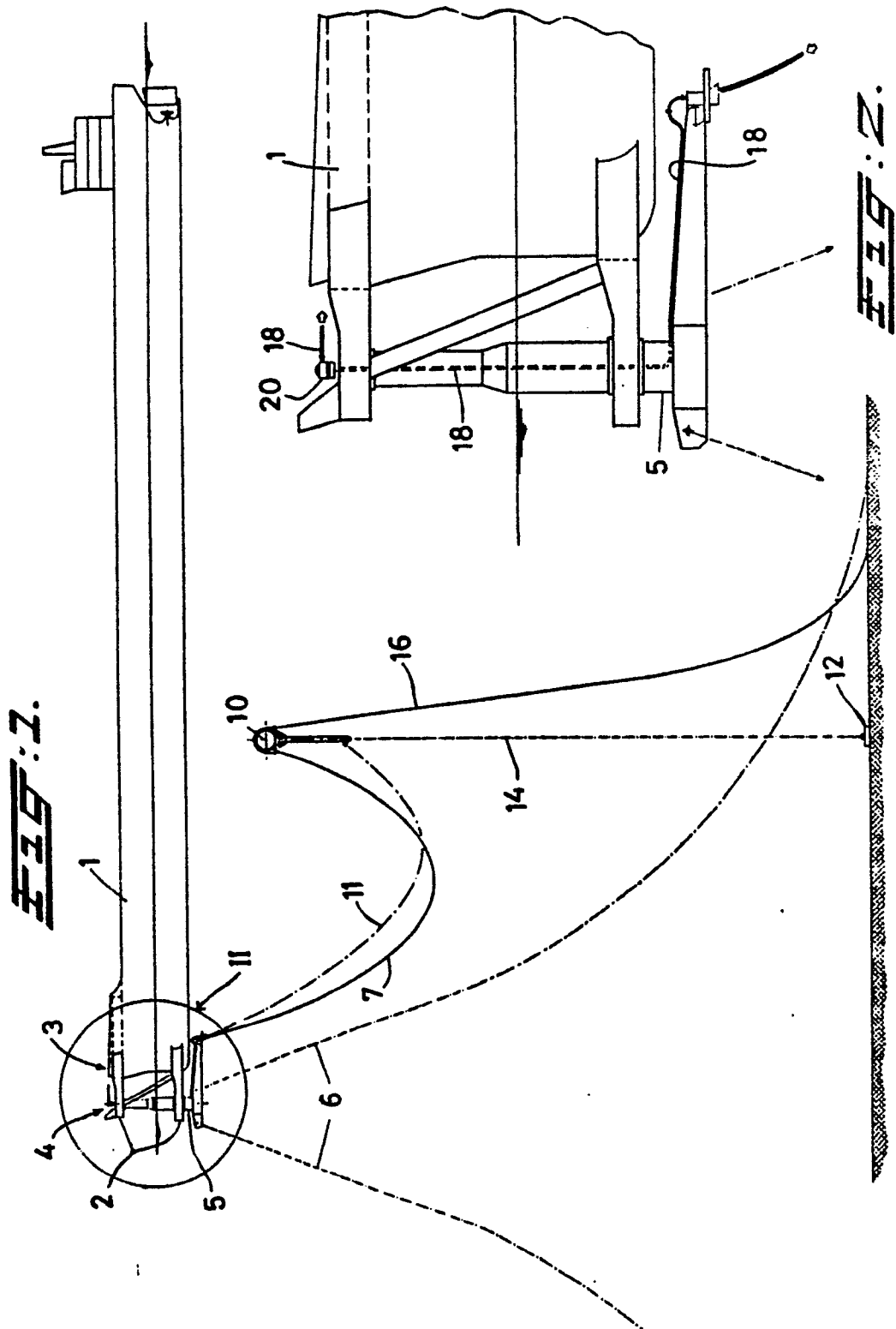
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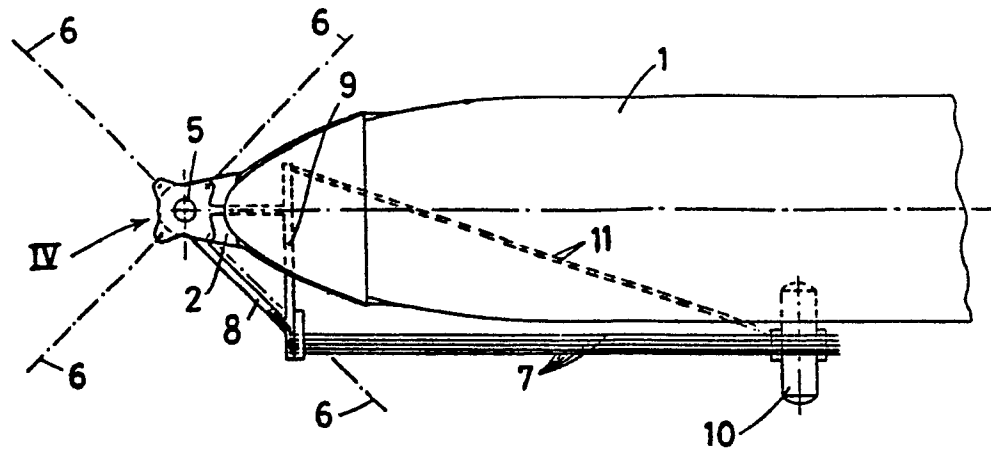
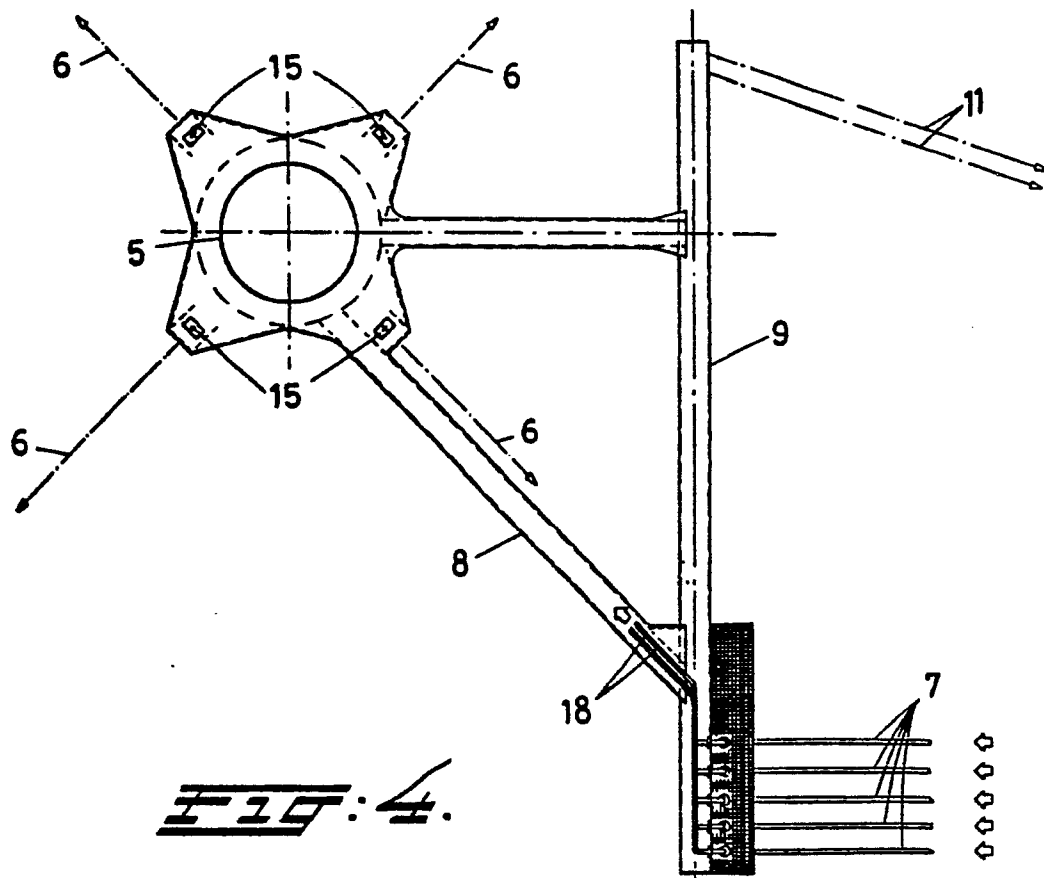


Fig: 5.



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