PATENT SPECIFICATION 977,451

DRAWINGS ATTACHED.

977,451

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COMPLETE SPECIFICATION.

Mooring Buoy.

We, SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ, N.V., a Company organised under the laws of the Netherlands, of 30 Carel van Bylandtlaan, The Hague, The Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

The invention relates to a buoy for mooring and loading and/or unloading and/or bunkering vessels, and is particularly concerned with a buoy which is provided with a float body having a central line with a swivelling coupling, the central line communicating, via flexible lines, with one or more lines secured to a turntable structure mounted on the float body in a rotary manner. A mooring buoy of this type can be anchored in open water. A tanker may then be moored to securing elements attached to the turntable structure, or with the aid of mooring hawsers made fast to such securing elements. The lines secured to the turntable structure may then be connected to the tanker, by means of floating hoses, in order to load, unload and/or bunker it ; during these operations the tanker may swing about the mooring buoy, thereby causing the turntable structure to rotate relatively to the float body, this rotation being followed by the swivelling coupling of the central line.

The purpose of the flexible lines and the lines secured to the turntable is to prevent sudden movements of the floating hoses and/or the mooring hawsers from exerting an excessive load on the swivelling coupling of the central line. A drawback of the known mooring buoy is, however, that at the line pressures required for smooth loading and unloading, great transverse hydraulic forces on the central line will occur, producing a considerable moment on the swivelling coupling of the central line.

According to the present invention a mooring buoy for mooring and loading and/or unloading and/or bunkering vessels is provided with a float body having mounted on it in a rotatable manner a turntable structure to which at least one line from a vessel may be secured and connected to a branched pipe, said branched pipe being connected to two flexible lines each extending via a connection to a swivelling coupling on a central line having an axis which coincides, or substantially coincides with the vertical central axis of the float body, the flexible lines joining the swivelling coupling at substantially diametrically opposite points at the same level in order to prevent a considerable moment on the swivelling coupling, due to hydraulic forces occurring during operation. Preferably, one flexible line takes substantially the shortest route between the branched pipe and the connection to the swivelling coupling on the central line, while the other flexible line is connected to the branch pipe by a bent intermediate line and preferably both flexible lines are substantially equal in diameter and length.

In the case of a mooring buoy which may be connected to a tanker by means of at least two hoses, the mooring buoy is preferably provided with two branched pipes arranged side by side, the corresponding bent intermediate lines being mounted on opposite sides of the central line.

The invention may be carried into practice in a number of ways but one specific embodiment will now be described by way of example with reference to the diagrammatic drawings, in which :—

Figure 1 is a vertical cross-section of a mooring buoy according to the invention ;

Figure 2 is a top-plan view of the mooring buoy; and

Figure 3 is a more detailed cross-section of one of the swivelling couplings shown in Fig. 1.

In Figure 1 a float body 2 of a mooring buoy is shown supported on a body of water 1 which is considered to be transparent. The body 2 consists of a hollow ring having a rectangular cross-section and provided on the inside with reinforcement elements and water-tight partitions (not shown). The outer periphery of the bottom part of the float body is provided with four connecting elements 3 for anchor chains 4, the elements 3 being mounted in the supporting structure 6 of a fender 5 projecting below the water line 1. A fender 7 is provided above the water line. The fenders 5 and 7 with their accessories are shown in Figure 1 only.

The deck of the float body 2 is provided with rails 8; sets of wheels 9 of a turntable structure 10 being adapted to run between these rails 8.

As shown in Figure 1 a line 11, the axis of which coincides with the central vertical axis of the float body 2, comprises three coaxial pipes 12, 13 and 14, the lower ends of which are fitted with connections 15 for hoses which may connect the mooring buoy to pipelines on the seabed. The outermost pipe 12 is secured to the float body 2 by means of beams 18 (two of which are shown in the drawing). The top ends of the pipes 12, 13 and 14 are provided with swivelling couplings 19, 20 and 21 respectively.

The topmost swivelling coupling 21 is of the axial type, as used, for example, in the swivel head of rotary drilling rigs. A rotatable head 22 with a hose connection 23 and a warning light 24 are provided above the swivelling coupling 21.

The bottommost swivelling coupling 19, which is of the same radial type as the middle one 20, is shown in greater detail in Figure 3. Two flanges 25 are welded to the middle pipe 13 above the top end of the outermost pipe 12, the flanges carrying a pipe-shaped element 26 with a flange 27 turned inwards above the flanges 25. The external diameter of the pipe-shaped element 26 is slightly less than the internal diameter of the pipe 12. A pipe length 28, which is provided with two diametrically opposite hose connections 29, is fitted at the bottom with a stuffing box 30 with packing 31 and a packing retaining ring 32 which are in sealing engagement with the outer wall of the pipe 12. Above the stuffing box 30 there is a flange 33 which is welded to the pipe length 28 and bolted to the box 30, the internal diameter of the flange 33 is equal to the internal diameter of the pipe 12. At the top of the pipe length 28 there is a stuffing box 34 with packing 35 and a packing retaining ring 36, which are in sealing engagement with a locking bush 37 fitting around and on the pipe-shaped element 26 and the flange 27. The pipe length 28 is thus rotatable relatively to the pipes 12, 13 and 14, and liquid flowing upwards in the pipe 12 outside the pipe 13 has to leave the pipe length 28 via the hose connections 29.

The pipe length of the coupling 20 (Figure 1) is likewise rotatable relatively to the pipes 12, 13 and 14, and liquid flowing upwards in the pipe 13 outside the pipe 14 can find a way out only through two hose connections 38. After removing the locking bush 37 (Figure 3), which is bolted to the flange 27, the pipe length 28 may be removed when the rotatable part of couplings 20 and 21 have also been removed.

As shown in Figure 1 a ball bearing 39 is fitted around the pipe 12, its inner race 40 being supported by the beams 18 and its outer race 41 being secured to the turntable structure 10 in a suitable manner. On the periphery the turntable structure 10 is kept in place by means of sets of wheels 9 which are hinged to the turntable structure 10.

As shown in Figure 2 connecting elements 42 for mooring hawsers 43 for mooring a tanker are arranged on the turntable structure above a number of sets of wheels 9.

The turntable structure 10 and everything secured to it can rotate relatively to the float body 2. Owing to the presence of the hingeable connections between the turntable structure 10 and the outer race 41 and the sets of wheels 9, the turntable structure can, in operation, transmit only axial forces to the rails 8 and only radial forces to the ball bearing 39.

As shown in Figure 2, three lines 44, 45 and 46 with valves 47, 48 and 49 are attached to the turntable structure 10 by means of clamps 51 and supports 52. Floating hoses may be coupled to these lines, which reach the water line 1 with S-bends, for loading, unloading and/or bunkering vessels. The side of the valve 49 facing the centre of the turntable structure 10 is connected to a line 50 with a flexible hose 53 (Figure 1) leading to the connections 23. The sides of the valves 47 and 48 facing the centre of the turntable structure 10 are connected to branch pipes 54 and 55, respectively, with branches 56 and 57 and 58 and 59. The branch 58 and the hose connection 29 facing the branch 58 are connected by a flexible hose 60. The branch 59 and the other hose connection 29 facing away from the branch 59 are connected by a bent intermediate line 61 and a flexible hose 62 (see Figure 1), the hoses 60 and 62 joining the swivelling coupling 19 at substantially diametrically opposite points as shown in Figure 2 and at

the same level as shown in Figure 1. The branch 57 is likewise connected, via a flexible hose 63, to the hose connection 38 of the pipe length of the coupling 20 facing this branch 57, while the branch 56 is connected, via a bent intermediate line 64 and a flexible hose 65, to the hose connection 38 of the pipe length of coupling 20 facing away from the branch 57. The bent intermediate lines 61 and 64 are so fitted on either side of the line 11 that space is left for other equipment on the turntable structure 10 (in Figure 2) in front of the intermediate line 64 and behind the intermediate line 61. It will be noticed that the flexible hoses 60 and 62 are substantially the same in length and diameter, as are the other pair of hoses 63 and 65.

The lines 44 and 45 are intended particularly for loading and/or unloading tankers. Hydraulic forces are set up during loading and unloading and their transverse components on the central line 11 will be substantially in equilibrium owing to the symmetrical position of the flexible hoses 63 and 65 and of the flexible hoses 60 and 62, and during operation only small moments will act on the swivelling couplings 19 and 20.

The line 46 with the line 50 and the hose 53 are intended particularly for bunkering vessels. The line pressures applied in this case are relatively low; it is therefore unnecessary to use a branch pipe and two hoses in this line, although it is quite possible to do so.

As required, mooring buoys having more or fewer lines and branch pipes may also be used.

WHAT WE CLAIM IS:—

1. A buoy for mooring and loading and/or unloading and/or bunkering vessels, which includes a float body having mounted on it in a rotatable manner a turntable structure to which at least one line from a vessel may be secured and connected to a branched pipe, said branched pipe being connected to two flexible lines each extending via a connection to a swivelling coupling on a central line having an axis which coincides, or substantially coincides, with the vertical central axis of the float body, the flexible lines joining the swivelling coupling at substantially diametrically opposite points at the same level in order to prevent a considerable moment on the swivelling coupling, due to hydraulic forces occurring during operation.

2. A buoy as claimed in Claim 1 in which one flexible line takes substantially the shortest route between the branched pipe and the connection to the swivelling coupling on the central line, while the other flexible line is connected to the branch pipe by a bent intermediate line.

3. A buoy as claimed in Claim 1 or 2 in which both flexible lines are substantially equal in diameter and length.

4. A buoy as claimed in Claim 2 or 3 including two branched pipes arranged side by side, the corresponding bent intermediate lines being mounted on opposite sides of the central line.

5. A buoy substantially as described herein with reference to the accompanying drawings.

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the same level as shown in Figure 1. The branch 57 is likewise connected, via a flexible hose 63, to the hose connection 38 of the pipe length of the coupling 20 facing this branch 57, while the branch 56 is connected, via a bent intermediate line 64 and a flexible hose 65, to the hose connection 38 of the pipe length of coupling 20 facing away from the branch 57. The bent intermediate lines 61 and 64 are so fitted on either side of the line 11 that space is left for other equipment on the turntable structure 10 (in Figure 2) in front of the intermediate line 64 and behind the intermediate line 61. It will be noticed that the flexible hoses 60 and 62 are substantially the same in length and diameter, as are the other pair of hoses 63 and 65.

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