June 8, 1965 H. WASSENAAR ETAL 3,187,355

MOORING BUOY

Filed Aug. 23, 1963 3 Sheets-Sheet 1

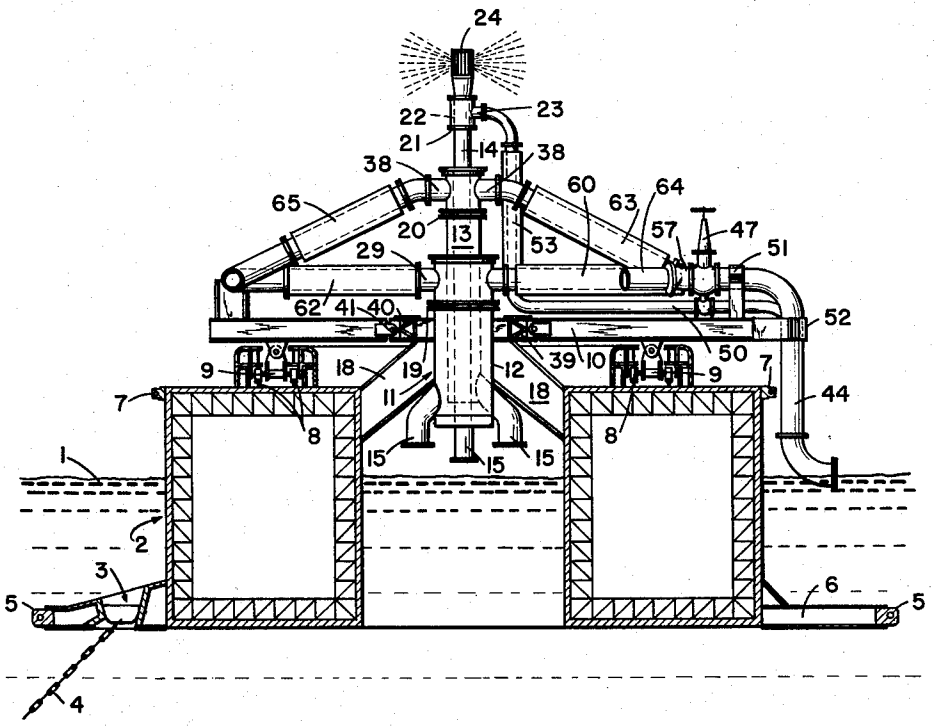


FIG. 1

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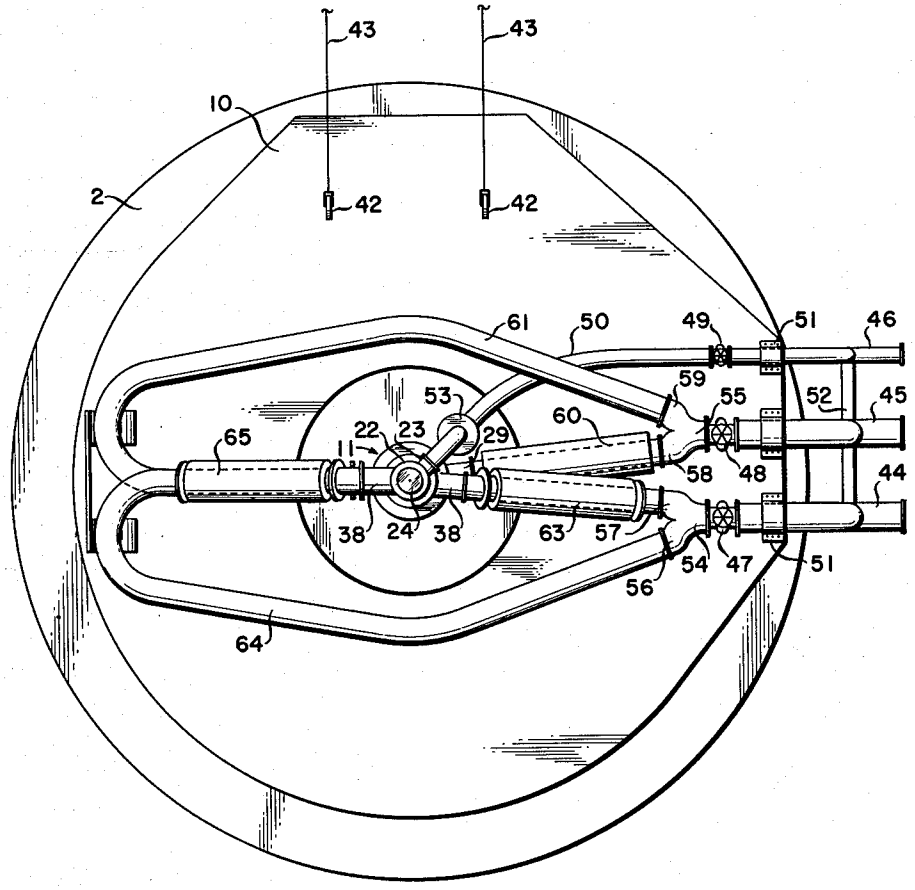


FIG. 2

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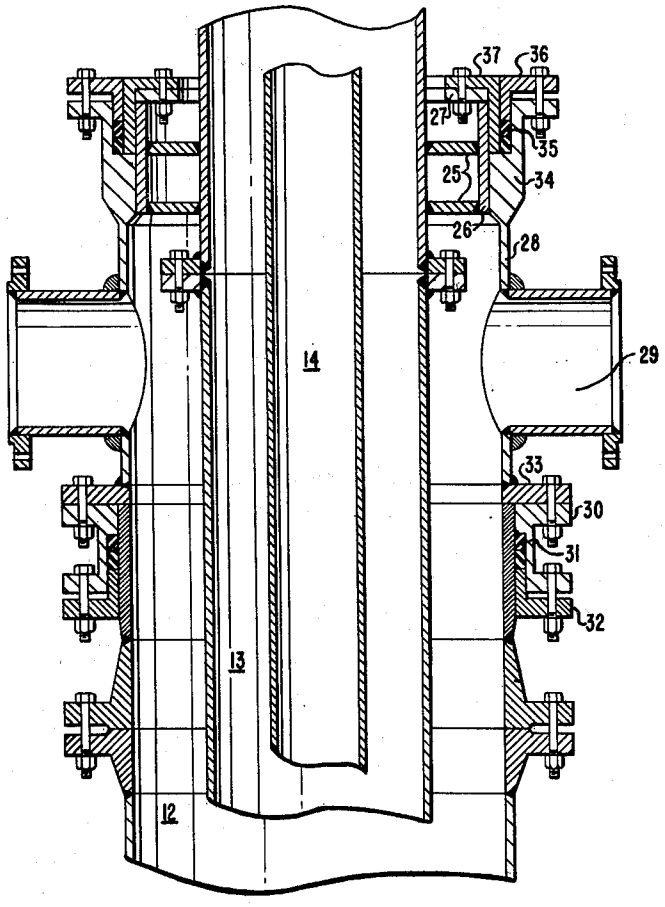


FIG. 3

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3,187,355

MOORING BUOY

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4 Claims. (Cl. 9—8)

The invention relates to a buoy for mooring and loading and/or unloading and/or bunkering vessels, which buoy is provided with a float body having a central line with a swivelling coupling, the said line communicating, via flexible lines, with lines secured to a turntable structure mounted on the float body in a rotatable manner. A mooring buoy of this type, which is known, for example, from the French patent specification 1,289,223, 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 relative 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.

In order to prevent such a moment from being produced, in a mooring buoy according to the invention, at least one line secured to the turntable is connected to two of the said flexible lines via a branch pipe, the axes of these flexible lines being substantially axially symmetrical relative to the axis of the central line. Preferably, one flexible line invariably takes substantially the shortest route between the branch pipe and a connection to the central line, while the other flexible line is connected to the branch pipe by a bent intermediate line, both flexible lines being 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 at least two branch pipes arranged side by side, the corresponding bent intermediate lines being mounted on either side of the central line.

The invention will be explained in greater detail with reference to the diagrammatic drawing, 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 FIGURE 1.

Referring to the drawing, the water is considered to be transparent; in FIGURE 1 the surface of the water is designated by 1.

The float body 2 of the mooring buoy consists of a hollow ring having a rectangular cross-section and provided on the inside with reinforcement elements and watertight 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, which elements are 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 accessories are shown in FIGURE 1 only.)

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

A tubular line 11, the axis of which coincides with the axis of the float body 2, is provided with three coaxial pipes or conduits 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 conduit 12 is secured to the float body 2 by means of beams 18 (two of which are shown in the drawing). The top end of each of the conduits 12, 13 and 14 is provided with a swivelling coupling 19, 20 and 21. 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 conduit 13 above the top end of the outermost conduit 12, which flanges carry a pipe-shaped element 26 with a flange 27 turned inwards above the flanges 25. The external diameter of the cylindrical wall 26 is slightly less than the internal diameter of the conduit 12. A pipe length 28, which is provided with two hose connections 29 diametrically opposite one another, 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 conduit 12; above the stuffing box 30 there is a flange 33, the internal diameter of which is equal to the internal diameter of the conduit 12. At the top of the conduit 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 relative to the conduits 12, 13 and 14, and liquid flowing upwards in conduit 12 outside conduit 13 has to leave the pipe length 28 via the hose connections 29. The pipe length of coupling 20 is likewise rotatable relative to the conduits 12, 13 and 14, and liquid flowing upwards in conduit 13 outside conduit 14 can find a way out only through the two hose connections 38. After removing the locking bush 37, which is bolted to the flange 27, the pipe length 28 may be removed when the rotatable parts of couplings 20 and 21 have also been removed.

A ball bearing 39 is fitted around the conduit 12, its inner race 40 being supported by the beams 18 and its outer race 41 being secured to the turntable structure 10 via tangential shafts. On the periphery the turntable structure 10 is kept in place by means of sets of wheels 9 which are hingeable about the tangential shafts.

Connecting elements 42 for the mooring hawsers 43 (FIGURE 2) 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 thereto can rotate relative to the float body. Owing to the presence of the said 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.

A number of conduits 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 center of the turntable structure 10 is connected to a line 50 with

a flexible hose 53 leading to the connection 23. The sides of the valves 47 and 48 facing the center of the turntable structure 10 are connected to branch pipes 54 and 55, respectively, with branches 56 and 57 and 58 and 59. Branch 58 and hose connection 29 facing branch 58 are connected by a hose 60. Branch 59 and the other hose connection 29 turned away from branch 59 are connected by a bent intermediate line 61 and a hose 62, hoses 60 and 62 being axially symmetrical relative to the axis of the central line 11. Branch 57 is likewise connected, via a flexible line such as a hose 63, to the hose connection 38 of the pipe length of coupling 20 facing this branch 57, while branch 56 is connected, via a flexible line such as a bent intermediate line 64 and a hose 65, to the hose connection 38 of the pipe length of coupling 20 turned away from branch 57. The bent intermediate lines 61 and 64 are so fitted on either side of the central 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.

The conduits 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 hoses 63 and 65 and of the hose 60 and 62, and during operations only small moments will act on the swivelling couplings 19 and 20.

The line 46 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.

We claim as our invention:

1. A buoy for mooring a floating vessel at an offshore location and communicating fluids thereto and therefrom, comprising:

(a) a float body having a central opening extending therethrough;

(b) a tubular line extending through said opening and providing means whereby conduits approaching the float body from above and below may be secured in fluid communication;

(c) connecting means secured to said line to provide for the connection of conduits thereto approaching from below the float body;

(d) swivel means secured to said line to provide for the pivotal connection of conduits thereto approaching from above the float body;

(e) a turntable mounted on said float body for rotation around said line in a plane substantially parallel

to the plane in which conduits connected to the swivel means move;

(f) at least one conduit secured to said turntable, said conduit having one end thereof adapted to be secured to a pipeline communicating with a floating vessel; and,

(g) a branched connector having one end secured in communication with the other end of said conduit and two ends flexibly connected in communication with said line, said two ends being connected to opposite sides of said line in substantially aligned axial relationship through said swivel means.

2. A buoy according to claim 1 wherein:

(a) one end of the branched connector is flexibly connected to the swivel means through a straight first section of flexible line that takes the shortest route between the connector and the swivel means; and,

(b) the other end of the branched connector is connected to the swivel means through a line whose terminal end is provided with a straight second section of flexible line which is of the same length and diameter as said first section of flexible line and which extends diametrically opposite said first section.

3. A buoy according to claim 1 wherein:

(a) at least two conduits are secured to the turntable; and,

(b) each of said conduits is flexibly connected in communication with opposite sides of said line through a branched connector communicating with said swivel means.

4. A buoy according to claim 3 wherein:

(a) the branched connector communicating each of said conduits with opposite sides of the line extending through the central opening communicates with the swivel means through a straight section of flexible line that takes the shortest route between the connector and the swivel means and a flexible line secured to a curved intermediate line; and,

(b) the curved intermediate line communicating with each branched connector passes on opposite sides of the line extending through the central opening.

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