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(54) **DOUBLE POINT MOORING SYSTEM**

ZWEIPUNKTVERANKERUNGSSYSTEM

SYSTEME D'AMARRAGE FUNICULAIRE

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention relates in general to mooring arrangements for vessels and in particular to a spread mooring arrangement for a permanently moored storage vessel to which a shuttle tanker is tied up along side during product transfer.

Description of the Prior Art

[0002] A shuttle tanker tied up beside a permanently moored storage tanker needs clearance between its hull and the anchor legs of the storage tanker.

[0003] There are many permanent mooring arrangements for storage tankers yet, a possibility exists for shuttle tanker entanglement with anchor legs of the permanently moored vessel, especially if anchor legs are secured mid-way between its stern and its bow or if anchor legs are secured mid-way between its stern and its bow or if anchor legs extend from the deck via the side of the vessel.

[0004] US-A-3,886,882, which constitutes the closest prior art, describes a multipoint mooring system with mooring lines at the bow of the vessel and mooring lines at the stern of the vessel, but each mooring line passes through a separate tube. Furthermore, some of the bow mooring lines extend in a rearward direction from the vessel, and likewise, some of the stern mooring lines extend in a forward direction from the vessel.

Identification of Objects of the Invention

[0005] It is an important objective of the invention to provide a mooring arrangement for permanently mooring a storage tanker in deep water (greater than 200 meters) which substantially prevents the possibility of entanglement of the shuttle tanker with the anchor legs of the storage tanker.

[0006] Another object of this invention is to provide a spread mooring at the bow end and the stern end of the vessel to allow large shuttle vessels to be tied up alongside the storage vessel in moderate environments for offloading of hydrocarbon product without the potential to entangle the permanently installed anchor legs of the storage vessel

[0007] Another object of this invention is to provide a double point mooring system for large vessels to be tied up together in moderate environments for offloading product from one vessel to another while providing space on the side of the storage vessel for the securement of production risers, work over risers or control umbilicals.

SUMMARY OF THE INVENTION

[0008] In shallow water, spread mooring systems have been used. The anchor legs of such spread mooring systems have normally been deployed from a top deck of the vessel from its sides, bow or stern. Placement of such spread anchor legs is likely to cause entanglement of a shuttle tanker when it is maneuvered for tying up the side of the storage vessel.

[0009] According to the invention, as defined by claims which follow, a double spread mooring arrangement is provided, one part at the stern, the other part at the bow of the storage vessel for deep water (greater than 200 meters) applications. Such placement of anchor legs away from mid-way between stern and bow provides a certain level of clearance of a shuttle tanker tied up to the side of the storage vessel. The bow and stern anchor legs enter the vessel not from the deck of the bow or stern or from its sides, but rather from beneath the vessel via a mooring insert tube through which anchor chains are pulled in from winches on the deck of the vessel. Because the anchor legs approach the vessel from the bottom of its keel, a further level of clearance is provided for deep water applications, which substantially insure that a shuttle tanker will not become entangled with the anchor legs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The various objects and advantages of this invention will become apparent to those skilled in the art upon an understanding of the following detailed description of the invention, read in light of the accompanying drawings which are made a part of this specification and in which:

In the Drawings:

Figure 1 is a plan view of a permanently moored vessel with a double point mooring arrangement according to the invention with a shuttle tanker tied up along its side;

Figure 2 is a cross sectional view taken along sections lines A-A of Figure 1 which illustrates anchor legs at the stern of the vessel entering a mooring insert tube of the vessel; and

Figure 3 illustrates the mooring insert tube of the mooring arrangement of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

[0011] A plan view is presented in Figure 1 of a permanently moored storage vessel 10 having a shuttle tanker 20 (shown fully loaded) tied up along its side for loading of product. Rubber fenders 50 protect the vessels from damage while being tied to each other. Flexible hoses 60 provide product flow paths from the permanent storage vessel 10 and the shuttle tanker 20.

[0012] The storage vessel 10 is moored to the sea bed by a double spread mooring arrangement comprising anchor legs 30 at the bow and anchor legs 40 at the stern rather than a single anchor leg pattern connected mid-way between bow and stern. The anchor legs are terminated at the sea floor by anchors. Such anchors may be of any of several known types in the art of mooring systems. Anchor legs 30 may include lengths of chain and wire or synthetic rope as well known in the art of mooring systems.

[0013] Anchor legs 30 at the bow are secured to vessel 10 by entering at a bottom end of a bow insert tube 100 which is placed on the longitudinal center line of the hull of the vessel and extends from the vessel deck 15 (or a chain pull-up deck) to the keel of the vessel. Each anchor leg 30 is pulled in and secured to the chain pull-up deck 15 of the vessel 10 by a double drum winch 17. Likewise, anchor legs 40 at the stern are secured to vessel 10 by entering at a bottom end of a stern insert tube 120 which is similar in construction to tube 100. Each anchor leg 40 is pulled in and secured to the chain pull-up deck 15 of the vessel 10 by a double drum winch 19. Different chain pull-up decks may be used under certain circumstances.

[0014] Figure 2 illustrates the two vessels 10 and 20 in a cross-section view along lines A-A of Figure 1. Because anchor legs 40 enter the insert tube 120 from beneath the permanently moored vessel 10, rather than from its side or the top of its bow or stern, and because the anchor legs 30 and the anchor legs 40 are connected to storage vessel 10 at its bow and stern, not mid-way between bow and stern, the shuttle tanker 20 has sufficient clearance from anchor legs 40 and anchor legs 30 to insure that there will not be entanglement.

[0015] The section view of Figure 2 further illustrates a riser porch 65 provided along the side opposite that to which the shuttle tanker 20 is tied up. Riser porch 65 provides a structure where production risers and control umbilicals 70 may be run and secured to the permanently moored vessel 10. Such riser porch 65 may be provided mid-way between stern and bow. Advantageously, the riser porch placed to the side of the permanently moored vessel 10 provides a large area for the combination of risers for production, re-injection or control umbilicals. This allows great flexibility and adaptability for the installation of such equipment in the event that production methods for the oil field were to change during its lifetime or in the event that adjacent production wells were to be required to be serviced by the vessel 10.

[0016] Figure 1 illustrates that a large deck space 16 is available for production processing equipment even where two mooring insert tubes 100, 120 are provided.

[0017] Figure 3 illustrates an anchor leg 30 being spooled onto the vessel by a drum winch 17. Each mooring insert tube assembly 100, 120 is welded into an existing tanker 10 structure, typically at an intersection of longitudinal and transverse bulkheads. The internal diameter of the mooring tubes may be three meters, for

example. Typically four anchor legs per tube are provided as illustrated in Figures 1 and 2. This arrangement maintains the integrity of the tanks of the vessel and provides a way to introduce mooring loads into the tanker.

[0018] The drum winches 17, 19 are preferably double drum winches to facilitate the hook up of the anchor legs 30 or 40 as the case may be. A chain-wire-chain anchor leg arrangement is illustrated in Figure 3, but of course other arrangements may be provided.

[0019] Although, the preferred embodiment of the double point mooring arrangement of Figures 1-3 is for a shuttle tanker 20 to be tied up along the side of the permanently moored vessel 10, the arrangement may be used for offloading systems at the bow and or stern of the vessel to better facilitate off loading. The same advantages of providing large clearance distances between the anchor legs 30, 40 and the off loading shuttle vessel reservoirs are achieved.

Claims

1. A mooring arrangement for a storage vessel (10) having a hull with a bow end and a stern end, comprising,

a bow mooring insert tube disposed in said hull at said bow end, said bow mooring insert tube extending from a bow chain pull-up deck (15) of the vessel to the open sea at a bottom end;

a plurality of bow mooring lines (30) extending between said bow chain pull-up deck of the vessel, through a bow mooring insert tube and to the sea floor;

a stern mooring insert tube disposed in said hull at said stern end, said stern mooring insert tube extending from a stern chain pull-up deck of the vessel to the open sea at a bottom end;

a plurality of stern mooring lines (40) extending between said stern chain pull-up deck of the vessel, through a stern mooring insert tube and to the sea floor;

characterized by

a single bow mooring insert tube (100) through which all of said bow mooring lines extend from said vessel in at least a partially forward direction;

a single stern mooring insert tube (12) through which all of said stern mooring lines extend from said vessel in at least a partially rearward direction;

whereby a double point spread mooring arrangement is provided in which the area of the sea between the two said mooring insert tubes is entirely clear of any mooring lines of said storage vessel.

2. The mooring arrangement of claim 1, further comprising,

a riser porch (65) secured to and extending outwardly of a first side of said vessel and spaced

generally midway between said bow mooring insert tube (100) and said stern mooring insert tube (120), said riser porch (65) arranged and designed for securement to said vessel of risers running between subsea wells and the vessel, when moored.

3. The mooring arrangement of claim 1, wherein, production risers (70) extend between subsea wells and the vessel, when moored.

4. The mooring arrangement of claim 1, wherein, work over risers and control umbilicals extend between subsea wells and the vessel, when moored.

5. The mooring arrangement of claim 2, further comprising, in combination with said storage vessel; an offloading vessel (20), secured alongside the storage vessel (10) wherein securement of said offloading vessel is placed between said bow mooring insert tube (100) and said stern mooring insert tube (120),

whereby the probability of entanglement of said offloading vessel with said bow mooring lines of said storage vessel and is decreased due to the coupling of said bow mooring lines (30) and said stern mooring lines (40) through openings at said bottom ends of said insert tubes (100, 12) in the bottom of the hull of said storage vessel.

Patentansprüche

1. Vertäuungsanordnung für ein Speicherschiff (10), das einen Rumpf mit einem Bugende und einem Heckende aufweist, welche folgendes umfaßt:

- eine Bugvertäuungseinsatzröhre, die in dem Rumpf an dem Bugende angeordnet ist, wobei die Bugvertäuungseinsatzröhre sich von einem Bugketteneinzugsdeck (15) des Schiffs zum offenen Meer an einem unteren Ende erstreckt,
- mehrere Bugvertäuungsleinen (30), die sich zwischen dem Bugketteneinzugsdeck des Schiffs und dem Meeresgrund durch eine Bugvertäuungseinsatzröhre erstrecken,
- eine Heckvertäuungseinsatzröhre, die in dem Rumpf an dem Heckende angeordnet ist, wobei sich die Heckvertäuungseinsatzröhre sich von einem Heckketteneinzugsdeck des Schiffs zum offenen Meer an einem unteren Ende erstreckt,
- mehrere Heckvertäuungsleinen (40), die sich zwischen dem Heckketteneinzugsdeck des Schiffs und dem Meeresgrund durch eine Heckvertäuungseinsatzröhre erstrecken,

gekennzeichnet durch

- eine einzelne Bugvertäuungseinsatzröhre (100), **durch** die sich alle Bugvertäuungsleinen von dem Schiff in eine wenigstens teilweise nach vorne weisende Richtung erstrecken,
- eine einzelne Heckvertäuungseinsatzröhre (12), **durch** die sich alle Heckvertäuungsleinen von dem Schiff in eine wenigstens teilweise nach hinten weisende Richtung erstrecken,

wobei eine beabstandete Vertäuungsanordnung an zwei Punkten zur Verfügung gestellt wird, in welcher der Meeresbereich zwischen den zwei Vertäuungseinsatzröhren vollständig frei von jeglichen Vertäuungsleinen des Speicherschiffs ist.

2. Vertäuungsanordnung nach Anspruch 1, die weiterhin folgendes umfaßt:

einen Riser-Vorbau (65), der an einer ersten Seite des Schiffs befestigt ist, sich von dieser nach außen erstreckt und allgemein auf halbem Weg zwischen der Bugvertäuungseinsatzröhre (100) und der Heckvertäuungseinsatzröhre (120) angeordnet ist, wobei der Riser-Vorbau (65) zur Befestigung von Risern an dem Schiff eingerichtet und konstruiert ist, die zwischen Unterseequellen und dem Schiff verlaufen, wenn es vertäut ist.

3. Vertäuungsanordnung nach Anspruch 1, bei der sich Produktions-Riser (70) zwischen Unterseequellen und dem Schiff erstrecken, wenn es vertäut ist.

4. Vertäuungsanordnung nach Anspruch 1, bei der sich Wiederaufwältigungs-Riser und Steuer-Versorgungsleitungen zwischen Unterseequellen und dem Schiff erstrecken, wenn es vertäut ist.

5. Vertäuungsanordnung nach Anspruch 2, die weiterhin in Verbindung mit einem Speicherschiff folgendes umfaßt:

ein Verladeschiff (20), das längsseits des Speicherschiffs (10) befestigt ist, wobei die Befestigung des Verladeschiffs zwischen der Bugvertäuungseinsatzröhre (100) und der Heckvertäuungseinsatzröhre (120) angeordnet ist, und die Wahrscheinlichkeit eines Verfangens des Verladeschiffs mit den Bugvertäuungsleinen des Speicherschiffs verringert ist aufgrund der Kopplung der Bugvertäuungsleinen (30) und der Heckvertäuungsleinen (40) durch Öffnungen an den unteren Enden der Einsatzröhren (100, 12) in dem Rumpfboden des Speicherschiffs.

Revendications

1. Système d'amarrage pour navire de stockage (10) possédant une coque présentant une proue et une poupe, comprenant,
 - un tube encastré d'amarrage de proue agencé dans ladite coque au niveau de la proue, ledit tube encastré d'amarrage de proue s'étendant depuis un pont de remontée de chaîne de proue (15) du navire jusqu'au niveau de la mer situé à une extrémité inférieure ;
 - une pluralité de d'amarres de proue (30) s'étendant entre ledit pont de remontée de chaîne de proue et le fond de la mer en passant à travers un tube encastré d'amarrage de proue ;
 - un tube encastré d'amarrage de poupe agencé dans ladite coque au niveau de la poupe, ledit tube encastré d'amarrage de poupe s'étendant depuis un pont de remontée de chaîne de poupe du navire jusqu'au niveau de la mer situé à une extrémité inférieure ;
 - une pluralité d'amarres de poupe (40) s'étendant entre ledit pont de remontée de chaîne de poupe du navire et le fond de la mer en passant à travers un tube encastré d'amarrage de poupe ;

caractérisé par

 - un unique tube encastré d'amarrage de proue (100) à travers lequel lesdites amarres de proue s'étendent depuis ledit navire dans au moins une direction partiellement en avant ;
 - un unique tube encastré d'amarrage de poupe (12) à travers lequel lesdites amarres de poupe s'étendent depuis ledit navire dans au moins une direction partiellement en arrière ;
 - d'où il résulte qu'il est prévu un système d'amarrage à deux points dans lequel la partie de la mer située entre lesdits deux tubes encastrés d'amarrage est entièrement dégagée des amarres dudit navire de stockage.
2. Système d'amarrage selon la revendication 1, comprenant en outre,
 - un portique (65) pour colonnes montantes, fixé à un premier côté dudit navire, s'étendant à l'extérieur de celui-ci et espacé généralement à mi-chemin entre ledit tube encastré d'amarrage de proue (100) et ledit tube encastré d'amarrage de poupe (120), ledit portique (65) pour colonnes montantes étant agencé et conçu pour fixer audit navire des colonnes montantes placées entre des puits sous-marins et le navire, lorsqu'il est amarré.
3. Système d'amarrage selon la revendication 1, dans lequel les colonnes montantes de production (70) s'étendent entre des puits sous-marins et le navire, lorsqu'il est amarré.
4. Système d'amarrage selon la revendication 1, dans

lequel

des colonnes montantes pour travaux de complètement et des dispositifs ombilicaux de commande s'étendent entre des puits sous-marins et le navire, lorsqu'il est amarré.

5. Système d'amarrage selon la revendication 2, comprenant en outre, en combinaison avec ledit navire de stockage :

un navire de transbordement (20), à couple du navire de stockage (10), l'amarrage dudit navire de transbordement se faisant entre ledit tube encastré d'amarrage de proue (100) et ledit tube encastré d'amarrage de poupe (120), dans lequel

la probabilité que ledit navire de transbordement s'emmêlent dans les amarres de proue dudit navire de stockage étant diminuée en raison du couplage desdites amarres de proue (30) et desdites amarres de poupe (40) via des ouvertures ménagées dans le fond de la coque dudit navire de stockage au niveau desdites extrémités inférieures desdits tubes encastrés (100, 12).

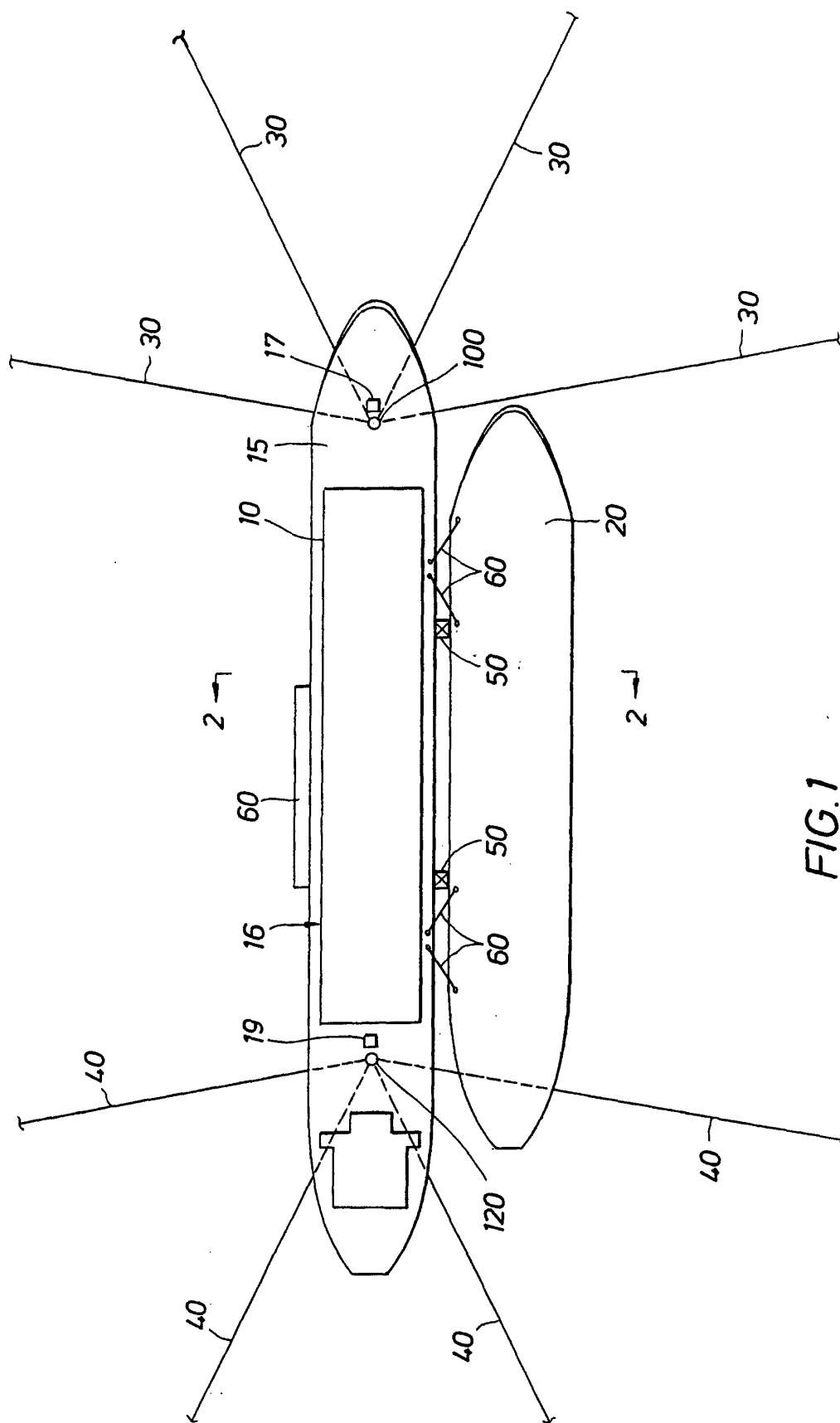
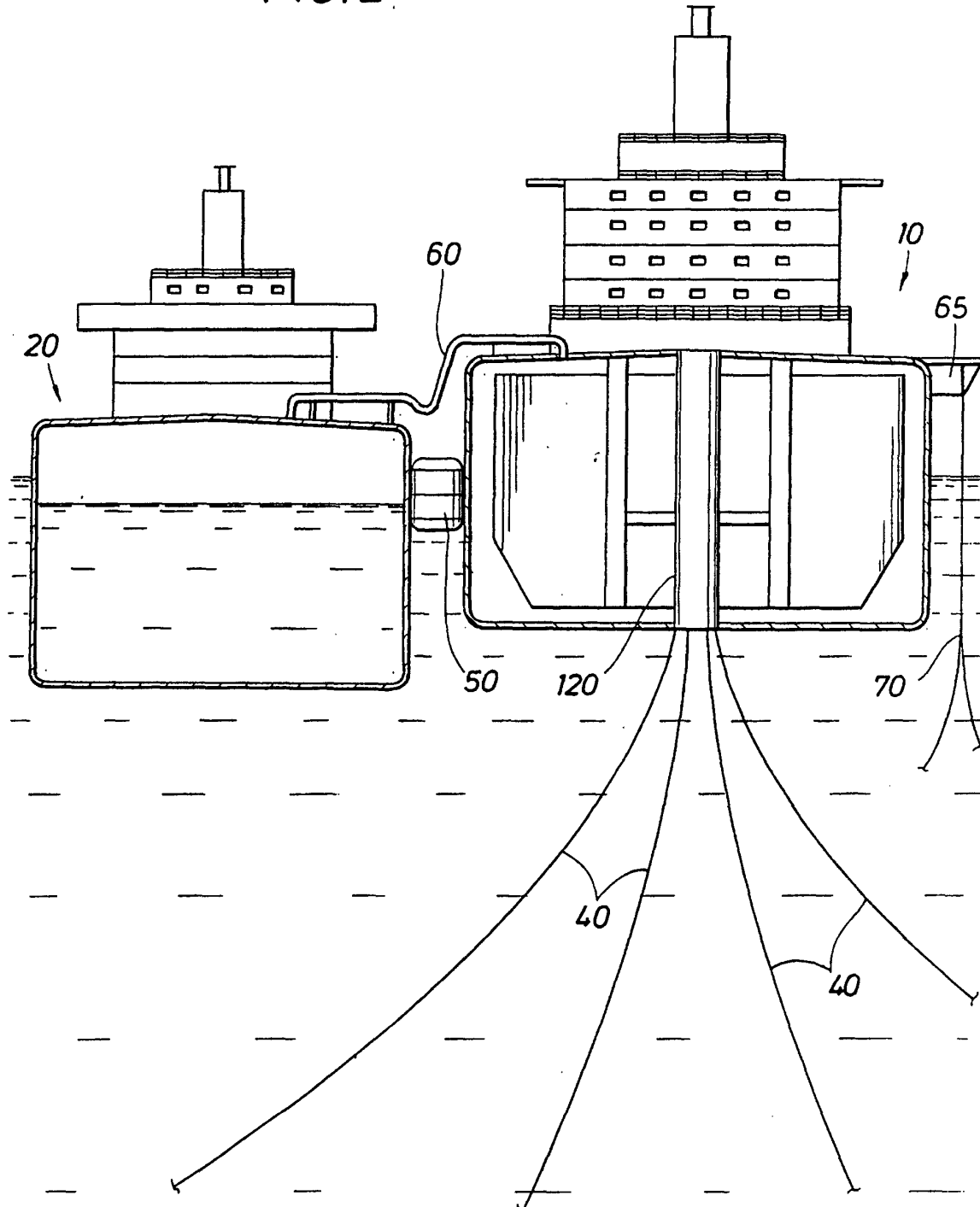


FIG. 2



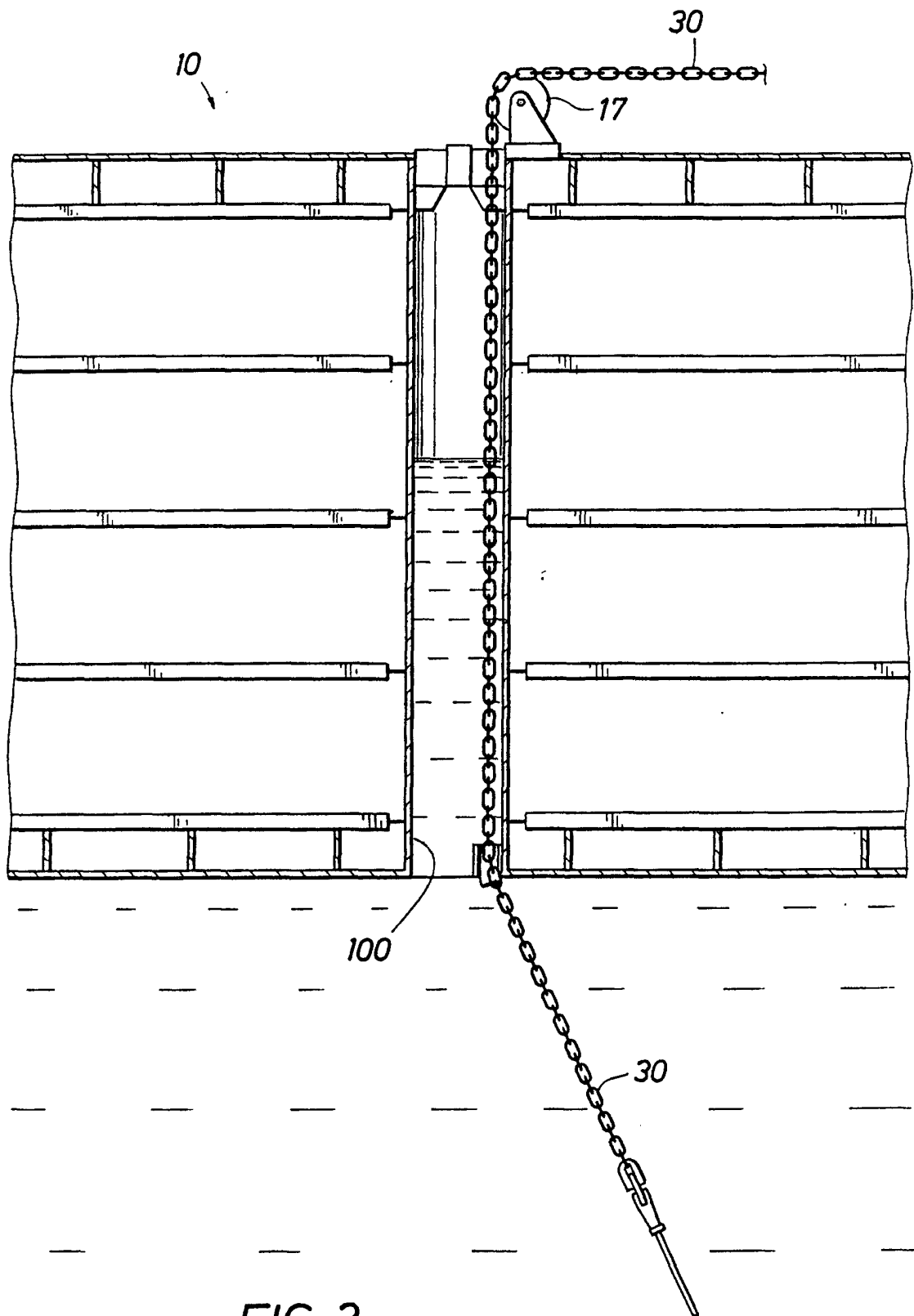


FIG. 3