Feb. 6, 1968 C. D. SUTTON 3,366,982

OFFSHORE FLOATING TERMINAL

Filed April 19, 1965

Fig. 1

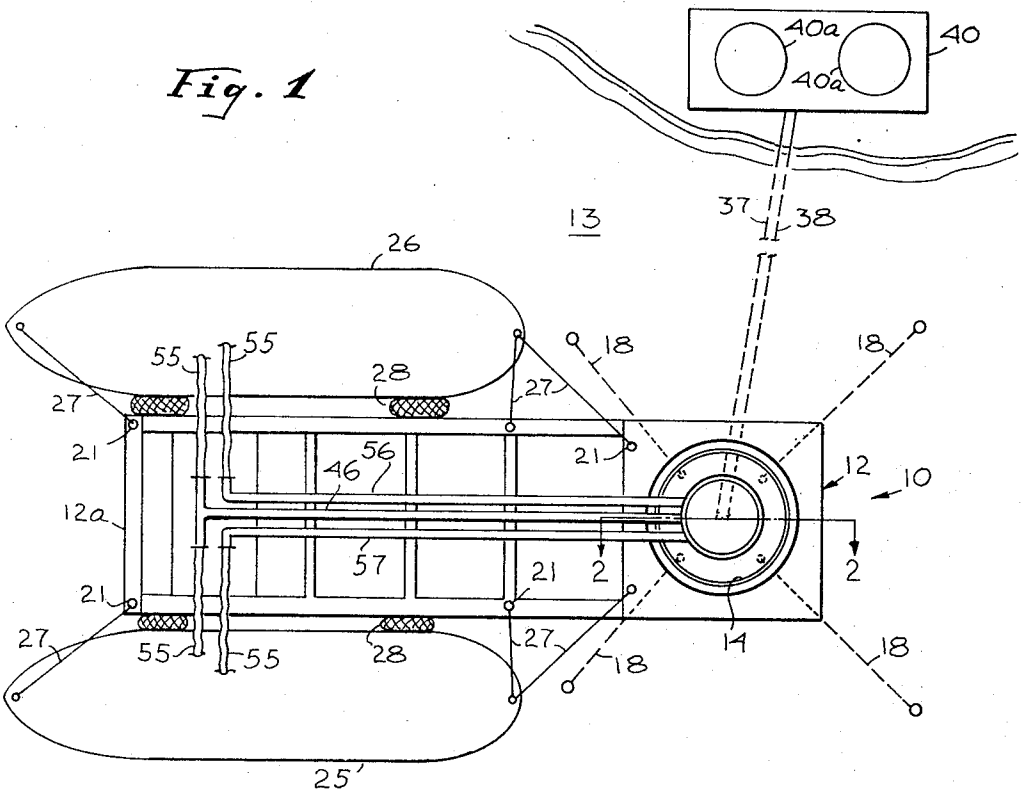
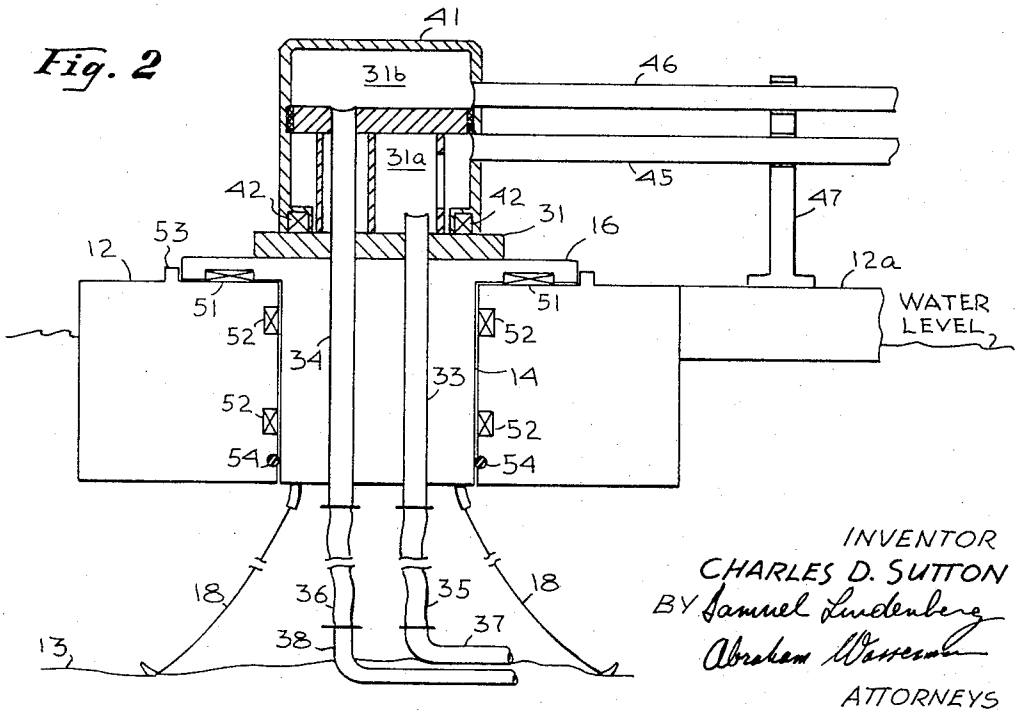


Fig. 2



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OFFSHORE FLOATING TERMINAL

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This invention relates to an offshore terminal and more particularly to improvements in an offshore floating terminal.

In U.S. Patent No. 3,082,440, issued on Mar. 26, 1963, entitled "Buoys for Ship Loading, Unloading or Bunkering," a novel buoy which serves as an offshore ship loading terminal is disclosed. Basically, the buoy is a floating structure which is anchored to the bottom of the sea by several anchoring chains so that it does not rotate despite forces of nature such as winds, waves, or sea currents. The buoy houses a non-rotatable internal multichamber unit, each chamber being connected by an undersea hose to a depot for storing liquids on the shore. Each of the chambers of the internal unit is in communication with a chamber in an external unit which is rotatably mounted on the internal unit. The external unit includes mooring means to enable a ship to be moored thereto. Flexible hoses connect the chambers of the external unit to the ship. Liquids may be pumped from the ship to the depot and/or from the depot to the ship flowing through the undersea hose and the buoy and the hoses coupling the buoy to the ship. The simultaneous but separate flow of a multiplicity of products in either parallel flow or counter flow mode is obtainable despite the fact that the ship is constantly moving around the buoy under the influence of wind, waves, and tides.

Such a floating offshore loading terminal has been found to be very advantageous since it enables the loading or emptying of ships without having to dock the ships at a conventional harbor. This is particularly advantageous since the draft and sizes of ships, such as tankers, is so large that they usually cannot be accommodated at all but a few docks. The buoy described in Patent No. 3,082,440 enables tankers to be rapidly loaded or unloaded without requiring conventional docking facilities. However, the construction, installation and maintenance of such buoys is quite high; therefore it must be operated as efficiently as possible in order to financially justify its use. This can be accomplished by increasing its capacity of transferring products from the depot to the mooring ship, as well as increasing the number of ships which the terminal can serve simultaneously.

Accordingly, it is an object of the invention to provide a new offshore loading terminal.

Another object of the invention is to provide a novel offshore floating terminal which is operable at high efficiency to justify its cost.

Yet another object is the provision of an offshore floating loading terminal which can be used to transfer simultaneously fluid products or fluidized solids to or from more than one ship.

These and other objects of the invention are achieved by an offshore loading terminal in which the internal non-rotating multichamber unit is mounted in a platform which is anchored to the sea floor by a plurality of anchoring chains, so that the platform does not rotate despite the forces of nature. A portion of the internal unit containing the chambers extends through the top of the platform above the water level. The external unit is rotatably mounted on the internal unit on top of the platform so that fluids and/or fluidized solids flow from an onshore depot coupled to the chambers of the internal unit by means of undersea hoses to the external unit, and therefrom to moored ships.

The non-rotating platform is surrounded by a barge which is rotatable about the platform. A floating pier forms an integral part of the barge so that when the barge is subjected to forces causing it to rotate about the anchored platform, the pier rotates therewith. The pier is long and wide enough to enable more than one ship to be moored thereto, so that the terminal can be used to simultaneously serve more than one ship. Thus, the efficiency at which the terminal is operated is greatly increased.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawings, in which:

FIGURE 1 is a plan view of an offshore floating loading terminal of the present invention; and

FIGURE 2 is a cross-sectional view along lines 2—2 of FIGURE 1.

Referring to FIGURE 1, there is shown a new offshore floating loading terminal **10** which comprises a barge structure **12** floating on the surface of a body of water or sea **13**. The barge structure **12** includes a floating pier **12***a*. In a tube-like opening **14** within the barge **12**, is mounted a platform **16** which is anchored to the bottom of the sea **13** by a plurality of mooring chains **18**. The chains **18** prevent the platform **16** from rotating or drifting under the forces of nature such as winds, waves or currents. However, the barge **12** is rotatably coupled to the platform so that the barge and the pier **12***a* are free to rotate about the center of the platform. The barge and pier include mooring hooks, bollards or bitts **21** used to tie up or moor tankers **25** and **26** to the pier by means of mooring cables **27**. The pier **12***a* is suitably fendered by guards **28** to prevent damage to the ships coming alongside it and to the pier itself.

Referring to FIGURE 2 which is a cross-sectional view along lines 2—2 of FIGURE 1, there is shown an internal multichamber unit **31** mounted on top of the platform **16**. Chambers **31***a* and **31***b* of unit **31** are connected by means of pipes **33** and **34** and flexible hoses **35** and **36** to submarine pipes **37** and **38** respectively. Pipes **37** and **38** are directly connected to an onshore depot **40** comprising fluid tanks **40***a*, so that fluids, such as lubricants, fuel or water, and certain solids, such as grains, crushed or pulverized products, may be directly supplied to and/or from the tanks and/or to the various chambers of the internal unit **31**. For explanatory purposes only, hereafter the invention will be described in conjunction with fluids which are transferred from the depot to the tankers. The term fluids is assumed to include various liquids, fluidized products, grain, gases, and any matter which can be transferred through pipes and hoses. It is appreciated that several different fluids may flow in parallel from shore to tanker or from the tankers to the shore. Also, different fluids may simultaneously flow in opposite directions, so that while certain fluids are transferred to the depot, other fluids are loaded aboard ship.

As seen from FIGURES 1 and 2, an outer unit **41** is rotatably mounted on unit **31**, by means of thrust bearings **42**. Pipes **45** and **46** are connected to the unit **41** so that any fluids from the tanks **40***a* in the chambers **31***a* and **31***b* may flow through pipes **45** and **46** respectively to or from either or both tankers. The pipes **45** and **46** are rigidly clamped to the pier **12***a* by means of clamp **47** so that the barge **12**, pier **12***a*, pipes **45** and **46** and unit **41** form a single relatively rigid structure. Hereafter, this structure will be referred to as the outer structure, or outer means.

Reference is again made to FIGURE 2. As seen, the non-rotating platform **16** which is anchored to the bottom of the sea **13** by chains **18** is positioned within the tube-like opening **14** in barge **12**. Thrust bearings **51** support the platform **16** on the barge **12**, while radial bearings **52** are placed in the tube-like opening **14** between the platform and the barge so that the barge and any tankers moored to its pier **12***a* can freely rotate about the platform **16**. Oil and water seal ring **53**, and water seal **54** protect the spacing between the platform **16** and the barge and the various bearings from exposure to corroding water or other undesired elements.

The pipes **45** and **46** may extend the length of pier **12***a* so that only very short coupling hoses **55** (FIGURE 1) are necessary to connect the pipes to the holds of the tankers. Although in the foregoing description unit **31** is shown comprising of only two chambers **31***a* and **31***b*, it is appreciated that it may comprise of more than two. Each chamber would be connected to depot **40** by a pipe, such as pipe **33**, flexible hose, such as hose **35**, and a submarine pipe such as pipe **37**. Unit **41** would then include additional pipes, such as pipe **45**, to be in communication with such a chamber so that several different fluids could simultaneously flow from the depot to pipes on the pier **12***a* and therefrom to the several tankers moored thereto. In FIGURE 1, pipes **56** and **57** are included to represent such additional capabilities.

From the foregoing, it is appreciated that in the novel floating loading terminal of the invention, different fluids can be caused to flow from depot **40** to chambers **31***a* and **31***b* (FIGURE 2) through pipes **37** and **38**, hoses **35** and **36** and pipes **33** and **34**. If the sea is calm, the pier-like barge **12**, the tankers and unit **41** will remain relatively stationary so that the liquids from chambers **31***a* and **31***b* will flow into pipes **45** and **46** to be supplied by means of hoses **55** to the tankers. Under relatively rough sea conditions, the barge and tankers will no longer be stationary. Rather, forces such as waves or winds will cause them to rotate as a single unit about the anchored platform **16**. However, since the unit **41** and pipes **45** and **46** form a part of the rigid structure which includes the barge and tankers, the flow of fluids from chambers **31***a* and **31***b* will continue uninterruptedly into the rotating pipes **45** and **46**.

The use of a relatively long pier greatly increases the efficiency at which the terminal can be operated, since several ships can be moored to the pier to be simultaneously loaded with fluids. Also the use of a pier to which tankers can be tied up enables the use of long pipes, such as pipes **45**, **46**, **56**, and **57**, so that the tankers can be coupled to the terminal by very short hoses **55**. This is particularly desirable since long flexible hoses which may float or are supported to float in the water are expensive. Also they tend to deteriorate in water so that they need be replaced occasionally.

There has accordingly been shown and described a novel offshore floating loading terminal which is particularly useful for simultaneously loading fluids from an onshore depot to more than one tanker moored offshore. The loading of fluids or any product which can flow through pipes and hoses can continue uninterruptedly despite rough sea conditions. Although the novel terminal of the invention has been described in conjunction with loading fluids from shore to tanker, it is apparent that the terminal can similarly be used to transfer fluids from the tankers to the depot on shore, as well as, simultaneously transfer different fluids in both directions. It is appreciated that modifications may be made in the specific arrangements as shown without departing from the spirit of the invention. Therefore, all such modifications are deemed to fall within the scope of the invention as claimed.

What is claimed is:

1. An offshore floating terminal for transferring fluids between a source of fluids and one or more tankers moored thereto offshore comprising:

a floating platform including a multichamber structure;

means for anchoring said platform to the bottom of a body of water off shore for preventing said platform from rotating;

means for transferring fluids between each of said chambers and said source of liquids;

a pier-like barge rotatably mounted about said platform said barge being dimensioned and including means for mooring tankers on either side thereof;

an outer structure rotatably mounted on said platform about said multichamber structure, said outer structure having openings in communication with said chambers; and

means having ends connectable to said tankers and other ends connected to said openings of said outer structure for transferring fluids between said tankers and said chambers.

2. In combination with an offshore floating terminal, said terminal including an anchored non-rotatable multichamber structure, an outer structure rotatably mounted thereon, a plurality of fluid containing means coupled to said outer structure for transferring fluids between said fluid containing means and each chamber of said multichamber structure, and means for transferring fluids between said chambers and an onshore fluid depot, an elongated pier-like barge rotatably mounted about said anchored non-rotatable multichamber structure, said barge including means for mooring a tanker on either side thereof and flexible hoses for connecting said fluid containing means to a tanker moored to said pier-like barge for transferring fluids between said tanker and said fluid containing means.

3. In combination with an offshore floating terminal of the type wherein fluids from an onshore fluid depot are transferrable to chambers of a non-rotating structure anchored to the bottom of a body of water, said structure being in communication with an outer structure rotatably mounted thereon, said outer structure having means coupled thereto for transferring the fluids from said chambers to a tanker moorable to said outer structure, a floating elongated pier-like barge rotatably mounted about said anchored non-rotating structure;

a plurality of pipes rigidly mounted along said pier-like barge, each pipe having one end thereof coupled to said rotatable outer structure for receiving fluid from another of said chambers;

means for mooring tankers on either side of said pier-like barge; and

short flexible hoses for coupling the other ends of said plurality of pipes on said barge to said tankers for transferring fluids from said chambers to said tankers.

4. The combination as recited in claim **3** wherein said pier-like barge is rotatably mounted around said anchored non-rotating structure about one end thereof.

5. An offshore floating terminal as recited in claim **3** wherein said pier-like barge of said outer structure is disposed along one direction with respect to said floating structure, whereby said pier-like barge and the tankers moored thereto are rotatable 360° about said floating structure, said floating structure being a pivotal point of rotation therefor.

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