United States Patent [19]

Stracke et al.

[11] **3,766,938**

[45] **Oct. 23, 1973**

[54] **CARGO TRANSFER SYSTEM FOR A FLOATING STORAGE VESSEL AND OFFTAKER MOORED IN TANDEM**

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[22] Filed: **Jan. 26, 1972**

[21] Appl. No.: **220,838**

[52] **U.S. Cl.**..... **137/355.16,** 137/355.28, 141/279, 141/386

[51] **Int. Cl.**..... **B65h 75/36**

[58] **Field of Search**..... 137/355.16, 355.12, 137/355.17, 355.18, 355.28; 141/279, 388, 387, 386

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Primary Examiner—Samuel Scott
Attorney—Leon Chasan et al.

[57] **ABSTRACT**

A cargo transfer system including a rack for the storage, retraction and paying out of a hose used in the transfer of cargo is mounted on a moored storage terminal (e.g. a permanently moored vessel or other suitable storage facility). The system includes means for mooring a tanker in tandem with the moored storage terminal and means such as a manifold for connecting the cargo hose between the terminal and the tanker. In one embodiment the rack is arranged to be raised and lowered by means of a hoist on the floating storage terminal.

7 Claims, 5 Drawing Figures

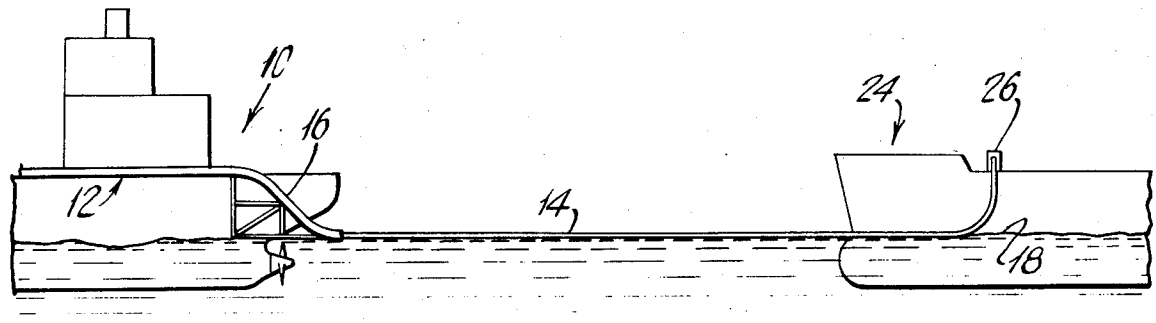


Fig. 1.

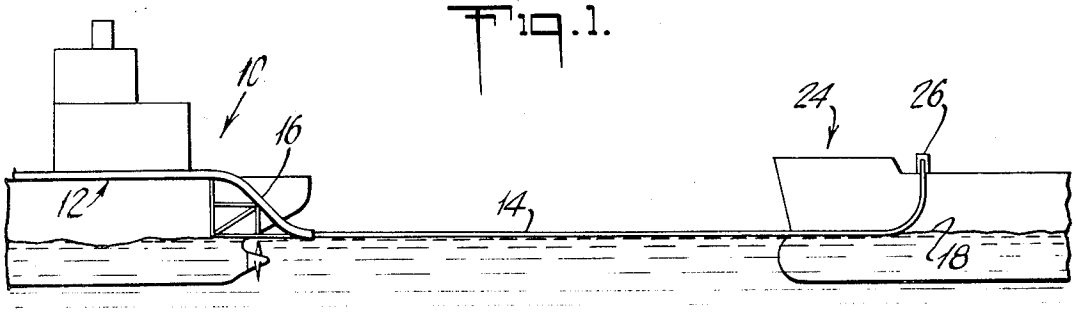
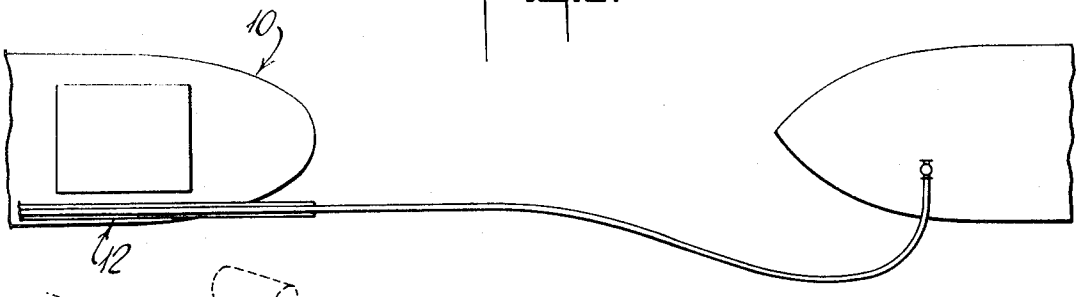


Fig. 2.



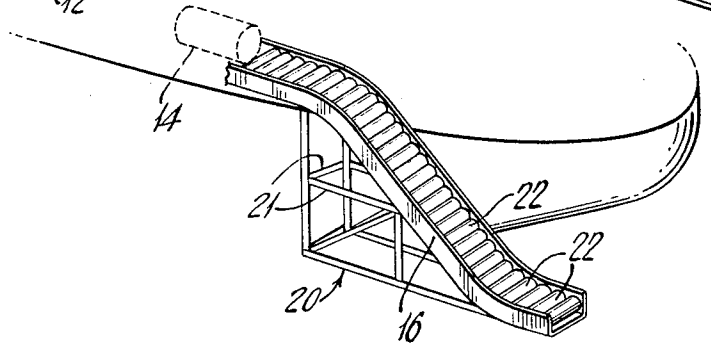


Fig. 3.

Fig. 4.

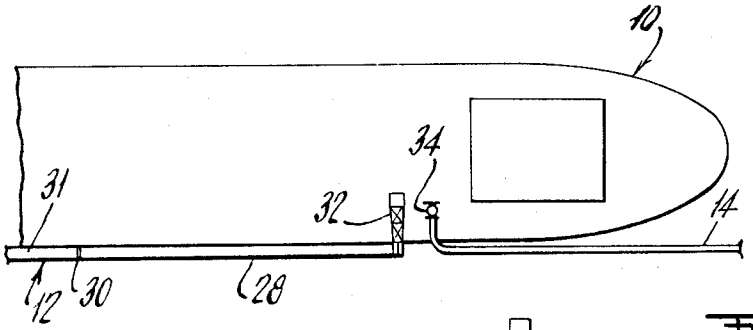
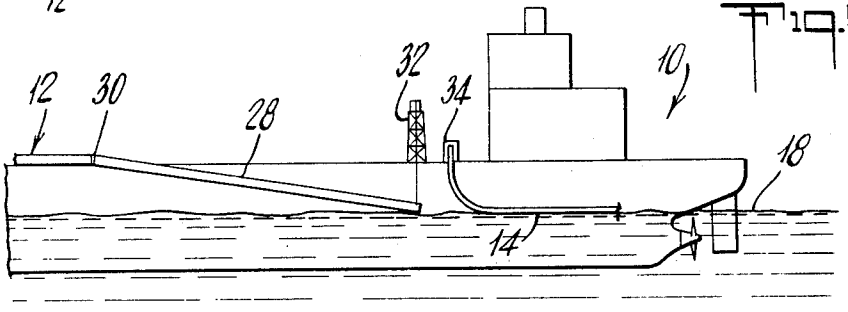


Fig. 5.



CARGO TRANSFER SYSTEM FOR A FLOATING STORAGE VESSEL AND OFFTAKER MOORED IN TANDEM

BACKGROUND OF THE INVENTION

Heretofore the transfer of liquid cargo such as oil from a floating offshore terminal or moored storage terminal which may comprise a tanker, to another tanker generally has been accomplished by mooring the two tankers in side-by-side relationship and transferring the cargo between the tankers over the rail. It has been found that such operations are only practical in seas of 10 feet or less. Where the seas are greater than 10 feet, the relative motions between the two vessels and the mooring and fendering forces are so large as to make such operations impractical. Thus, there exists a need for an efficient method of transferring cargo from vessel to vessel as an integral part of a floating offshore attended terminal. As a result of various test programs, it has been determined that tandem mooring of vessels is feasible in seas up to 15 feet, which is considered to be a relatively severe environment. Basically a tandem mooring system utilizes a permanently moored storage member or float such as a tanker, to load a shuttle tanker or offtaker. The use of separate moorings for both the floating storage terminal and the offtaker, while shown to be possible in seas greater than 15-foot significant wave height, is considered uneconomical.

DESCRIPTION OF PRIOR ART

In addition to the previously discussed prior art systems employed in the transfer of liquid cargo between two floating members such as a float and an offtaker, the prior art deemed closest to the present invention is in a nonanalogous area relating to the fueling of ships at sea. Typical of this prior art is the Miller U.S. Pat. No. 1,685,927 which discloses a system for fueling ships at sea while the ships are traveling at a considerable speed. The hawsers and fuel hoses employed in the fuel transfer system are suspended from fixed supports and are tensioned by means of engines. Messenger lines are utilized in conjunction with the hawsers. Other ship fueling disclosures include the Silvesten U.S. Pat. No. 3,154,118.

SUMMARY OF THE INVENTION

The present invention relates to a novel cargo transfer system employing tandem mooring. In its broad aspect the invention includes a permanently moored floating, offshore attended terminal (e.g., a tanker or specially designed storage vessel) which for convenience is referred to throughout this disclosure as the float, for loading a tanker which is referred to throughout this disclosure as the offtaker. A system constructed and arranged according to the present invention includes a rack for storing, retracting and paying out the large bore, stiff, floating hose used in the transfer of the liquid cargo between the float and the offtaker to achieve high transfer rates. Suitable means for mooring the offtaker and a manifold for connecting the cargo hose at each end are also provided. The float has associated therewith the rack, which in one embodiment of the invention is adapted to be raised and lowered by means of a hoist also located on the float. Another embodiment comprises constructing the rack internal to the float. The rack provides a means whereby

the large bore, stiff hose can be stored, which will usually be necessary during severe sea conditions. In order to minimize the amount of pull necessary to retract the hose from the water surface and for support, the rack is provided with a plurality of rollers. When the hose is in service or during retraction or payout, in order to minimize damage thereto the outboard end of the rack is constructed so that it prevents the hose from being bent or curved beyond its minimum bend radius. By connecting the hose to appropriately located manifolds, the movement of the hose due to pitch is significantly reduced when severe sea conditions exist. The mooring of the offtaker and connection of the hose can be accomplished by a variety of means. For example, one such means might include the use of a helicopter which can deliver a messenger line to the offtaker which then can take in on the mooring line which is connected to the messenger line. Likewise, a line attached to the hose can be delivered to the offtaker by a line-throwing gun whereupon the offtaker can pull out the hose and attach it to its manifold.

Accordingly, it is a primary object of the present invention to provide means for connecting an offtaker to a float in conjunction with a feasible cargo transfer system for a float and offtaker moored in tandem.

A further object of the present invention is to provide a cargo transfer system between a float and an offtaker, which is economical and capable of operating in relatively severe environments.

Still yet a further object of the present invention is to provide a tandem moored float and offtaker with means for safely stowing the cargo transfer system during very severe environments.

Having in mind the above and other objects and advantages that will be apparent from an understanding of this disclosure, the present invention comprises the combinations and arrangments as illustrated in the presently preferred embodiments of this invention, which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the function, operation, construction and advantages of it when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 discloses a schematic elevation view of a cargo transfer system for tandem moored vessels in accordance with the present invention;

FIG. 2 illustrates a top plan view of the system of FIG. 1;

FIG. 3 illustrates a perspective view of the outboard end of a rack constructed in accordance with the present invention;

FIG. 4 illustrates an alternate embodiment of the cargo transfer system wherein a pivotally movable rack is employed; and

FIG. 5 illustrates a schematic side elevation view of the embodiment of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Having reference to the drawings wherein like parts are designated by the same reference numerals throughout the several views, the present invention is illustrated in FIG. 1 wherein the float or permanently moored storage unit **10** comprises a tanker moored in tandem with a shuttle tanker or offtaker **24**. However, it should be clearly understood that while throughout

the disclosure and in the drawings the float comprises a tanker, other suitable floating members such as permanently moored floating storage tanks, specially designed vessels, or the like can be employed. As illustrated, the float **10** has secured thereto a rack, generally designated **12**, for use in the storage, retraction and paying out of a cargo transfer hose **14**. FIGS. **1** and **3** show that the rack is located at the stern of the float **10** and includes an outboard end **16** provided with a downward and thence outboard extending curvature. The terminal portion of the rack end **16** is designed to be substantially parallel with the water surface **18**. This configuration of the outboard end of the rack prevents the hose from being bent or curved beyond its minimum bend radius. A suitable L-shaped framework **20**, including appropriately designed interconnecting structural members **21**, supports the outboard end **16** in the desired configuration. To facilitate storage, retraction and paying out of the hose **14** and to minimize the pull necessary during these operations, the rack **12** along its entire length is provided with a plurality of rollers **22**. In FIG. **1** the hose **14** is shown in its extended position connected to the shuttle tanker or offtaker **24**. The hose extends from the stern of the float **10** and can be connected to the offtaker **24** by any one of the several means previously discussed. The hose is connected to a manifold schematically illustrated as **26** on the offtaker. The manifold **26** preferably is located as near as possible to the bow of the offtaker. For instance by locating the manifold at approximately the point where the parallel sides of the offtaker **24** begin, any movement of the hose due to pitch is substantially reduced. The float end of the hose **14** also is connected to a manifold (not shown) which may be located similar to the location manifold **26** on the offtaker, relative to the parallel sides of the float **10**.

FIGS. **4** and **5** illustrate another embodiment of the present invention. In this embodiment the rack **12** is provided with a movable end portion **28** which pivots about a forward point designated **30** located at the terminal end of the stationary portion **31** of the rack. The entire rack, including the outboard end **28**, is disposed laterally or outboard of one of the parallel sides of the float **10**. The free end of the movable portion **28** is connected to suitable means such as a standard hoist **32** which enables this portion of the rack to be raised and lowered for storage in a safe position. Thus, when the hose is stored, the rack will be disposed in a substantially horizontal position. To pay out the hose **14**, the movable rack portion **28** is lowered to the position shown in FIG. **5**, and the hose is delivered therefrom and connected to the manifold on offtaker **24**. When the other end of the hose **14** reaches approximately the point of the manifold **34** located on the float **10**, it is suitably connected thereto and assumes the position substantially as illustrated in FIGS. **4** and **5**.

It will be appreciated from the foregoing description that there has been provided a novel high capacity cargo transfer system for a tandem moored float and offtaker. It should be understood, however, that the constructions and arrangements herein illustrated and described are intended to be representative only of preferred embodiments and that certain changes readily may be made therein without departing from the clear teachings and scope of the present invention. Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.

What is claimed is:

1. A cargo transfer system for floating vessels comprising in combination, a first permanently moored cargo storage member and a second vessel moored in tandem with said first moored member, said first member and said second vessel being located offshore, longitudinal extending rack means generally parallel with the water surface operably connected with said first member for the storage, retraction and paying out of a cargo transfer hose adapted to be connected between said first member and said second vessel, said rack means including an end portion constructed and arranged to prevent said hose from being bent beyond its minimum permissible bend radius when said hose is in its paid-out position, said rack means also including means for facilitating movement of said hose, and manifold means associated with said first member and said second vessel for connecting the ends of said hose thereto.

2. A cargo transfer system according to claim **1** wherein said means for facilitating movement of said hose comprises a plurality of rollers disposed for substantially the length of said rack means.

3. A cargo transfer system according to claim **1** wherein said first moored cargo storage member comprises a vessel having a configuration generally like that of said second vessel.

4. A cargo transfer system according to claim **1** wherein said end portion of said rack means is disposed proximate the stern of said first member.

5. A cargo transfer system according to claim **4** wherein said end portion has a configuration comprising a downwardly curved portion terminating in substantially horizontal disposition at the operating waterline of said first member.

6. A cargo transfer system according to claim **1** wherein said end portion of said rack means comprises a pivotally movable member adapted to be raised and lowered.

7. A cargo transfer system according to claim **6** wherein said end portion of said rack means is disposed lengthwise and outboard of a parallel side of said first member.

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