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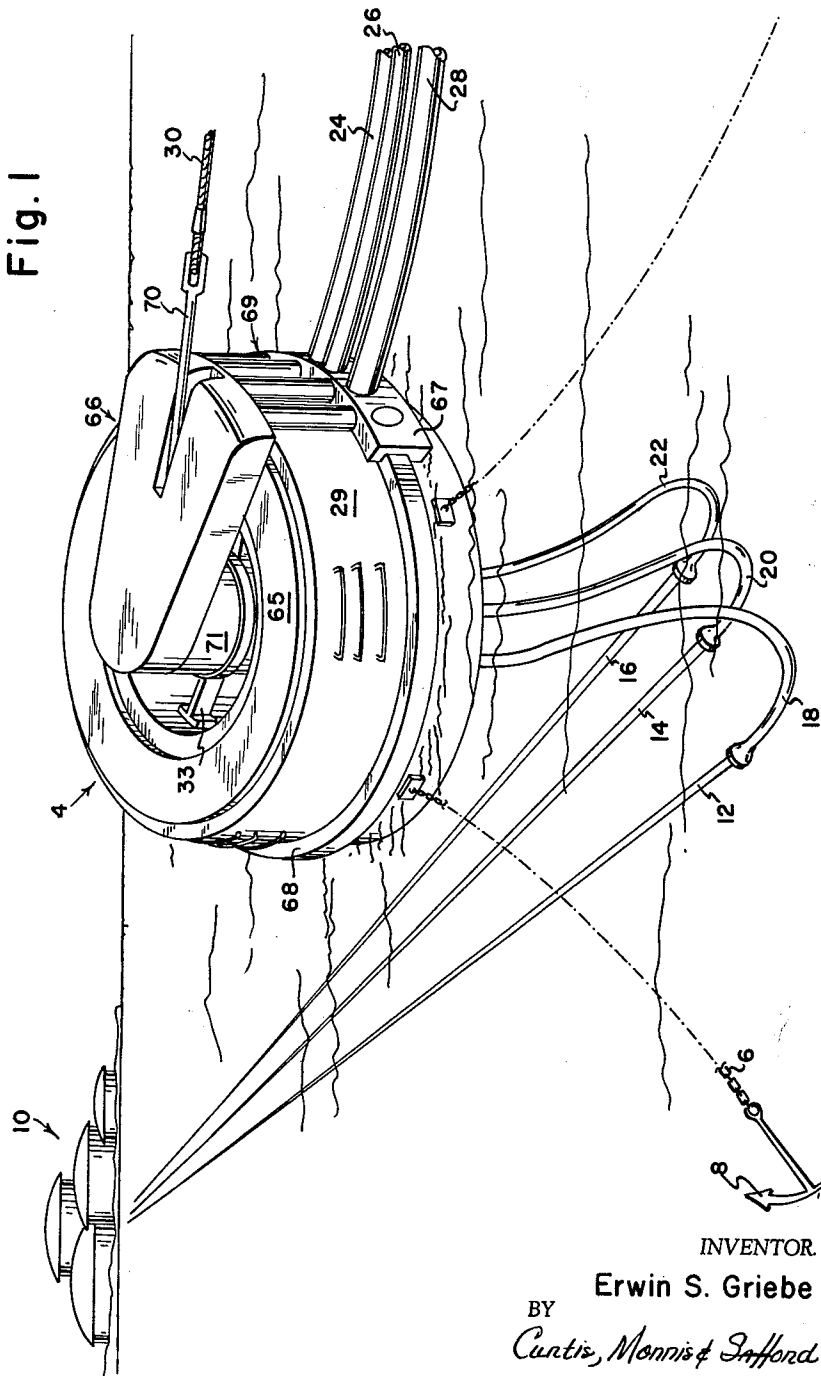
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3,074,082

TERMINAL STATION AND SYSTEM AND METHOD

Filed July 13, 1959

2 Sheets-Sheet 1



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Fig. 2

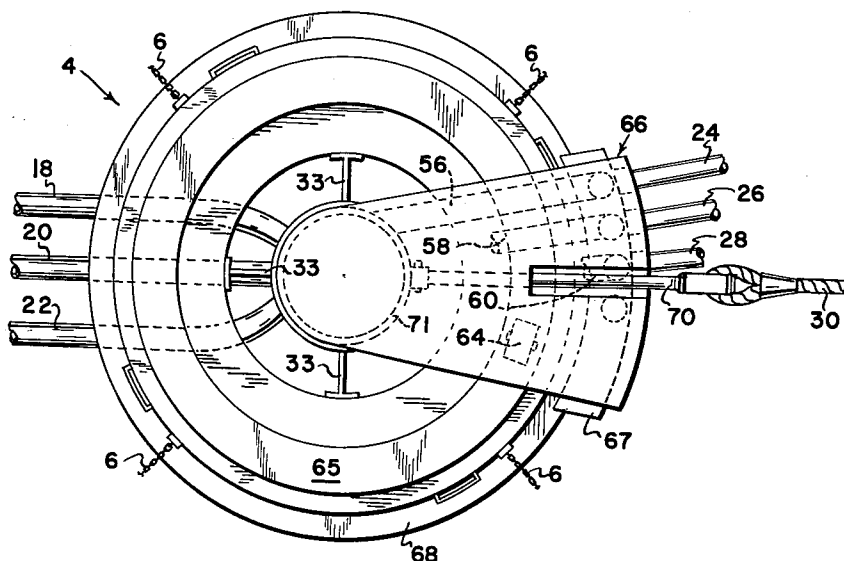
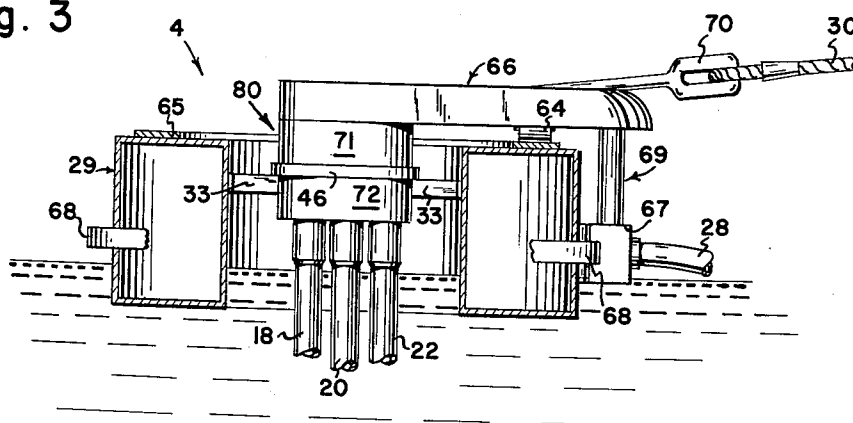


Fig. 3



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TERMINAL STATION AND SYSTEM AND METHOD

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4 Claims. (Cl. 9-8)

This invention relates to loading, discharging and bunkering ships, and more particularly to an improved method, system and apparatus for loading and discharging liquids to and from tankers and other vessels, and providing for the handling of such liquids and fluid cargos generally, and also for the simultaneous supply of fresh water and fuel to the vessel. The invention also relates to particular facilities for use in connection with the above-mentioned operations.

An object of this invention is to provide an improved arrangement for loading and discharging fluid cargos to and from ships and bunkering ships and other vessels. A further object is to provide apparatus for facilitating the loading and discharging of fluids to and from ships carrying fluid cargos such as crude oil, petroleum, chemicals, paints, oils, fruit juices, etc. A further object is to provide sea terminal stations for ships whereby they may be loaded or discharged or provided with fresh water and fuel without requiring them to go into port or use coastal stations. A further object is to provide a thoroughly practical and efficient loading, discharging and bunkering facility for ships at stations located at some distance from shore. A further object is to provide apparatus and equipment for carrying out the above in a manner so as to avoid the difficulties which have been encountered with present methods and systems. A further object is to provide for the above with arrangements and equipment which are adaptable to many conditions which are encountered in installation and use.

These and other objects will be in part obvious and in part pointed out below.

In the drawings:

FIGURE 1 is a perspective and somewhat digrammatic representation of one embodiment of the invention;

FIGURE 2 is a top plan view of the float of FIGURE 1; and

FIGURE 3 is a partially sectional view of the float of FIGURE 1, showing some parts in side elevation.

This application is a continuation-in-part of my co-pending application, Serial No. 630,981, filed December 27, 1956, and issued July 14, 1959, as Patent No. 2,894,268. The invention disclosed herein is related to, and in some respects is an improvement upon the invention disclosed in said co-pending application.

In the past there has been a need for improved methods and facilities for loading and discharging vessels carrying fluid cargos such as crude and refined petroleum, chemicals and other liquids, and for supplying fuel and fresh water to seagoing vessels and other craft requiring fuel and fresh water.

The loading and discharging and bunkering of such vessels from coastal docks presents hazards including water pollution and fire hazards due to spilled oil, and possible collision and explosion; and it also threatens the safety of nearby vessels and the shore line and storage tank installations and facilities.

The loading, discharging and bunkering of vessels from coastal docks also presents grounding hazards to larger vessels, especially tankers and super-tankers, due to shoal water and narrow navigable channels; and also the hazards due to wind and storm and other poor weather conditions.

In the past, loading, discharging and bunkering stations have been proposed and provided at locations re-

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mote from shore, but these have proved unsatisfactory during bad weather and other conditions of operation. They have required that vessels cut all lines loose suddenly to prevent damage to vessel and installation when sudden changes in weather conditions required. Moreover, such offshore stations are useful only during daylight hours due to the need for maximum visibility in connection with using such installations.

The increased size of vessels and tankers require deeper channels and longer docks, both entailing costly and time consuming operations.

There is a great need for emergency dock facilities in crowded harbors and for emergency fueling facilities in time of war, as well as for temporary transfer facilities for products from oil fields through pipe lines.

It is an object of this invention to provide satisfactory offshore loading, discharging and bunkering facilities which avoid the difficulties referred to above.

There is a great need for increased facilities to furnish fuel to the growing number of smaller fishing vessels, work boats and harbor craft, as well as pleasure craft operating in inland waterways, harbor and rivers.

Another object of this invention is to provide facilities in inland waterways, harbors and rivers for mooring and supplying fuel and water to fishing vessels, work boats, harborcraft and pleasure boats. The facilities provided by this invention will accommodate several smaller craft at the same time.

Referring to FIGURE 1 of the drawings, a ship (not shown) is moored to a loading, discharging and bunkering terminal 4 which is anchored by a plurality of chains 6, each having an anchor 8 at its ends. Except as otherwise disclosed, the structure of terminal 4 is identical with that disclosed in my above-identified patent. On shore storage tanks 10 are illustrated, and submerged pipelines 12, 14 and 16 connect these storage tanks to the ship. An alternate arrangement provides for a pipeline 12 to connect the ship to an offshore drilling barge or refinery, or to another ship. Pipelines 12, 14 and 16 are connected respectively through flexible lines 18, 20 and 22 to terminal 4. Terminal 4 has a rotatable transfer assembly 66 which is provided with rollers 64 which ride on the top of an annular float 29 within the limits of a track surface 65 mounted concentrically on the top of float 29. Thus, assembly 66 is partially supported by rollers 64, and is permitted to ride freely around the float. Assembly 66 is pivotally supported at the center of the float by a rotatable portion 71 of a multi-chambered transfer core structure 80 which is supported by a stationary portion 72 of the multi-chambered transfer core structure. Structure 80 is rigidly supported by a pair of frame members 33 which extend radially and are secured to the inner cylindrical wall of float 29. A swivel seal 46 is provided between the rotatable portion 71 and a stationary portion 72 of multi-chambered transfer center core structure 80; seal 46 is of such configuration as to provide swivel sealing between each of the internal chambers of core structure 80, each chamber being concentric with its corresponding or mating chamber. This permits continuous flow between the corresponding stationary and rotatable chambers, and seals off each continuous passageway from each and every other continuous passageway provided by said chambers. Therefore, there may be continuous passage of fluids of like or different nature through the transfer assembly, simultaneously and in the same or opposite directions, without leakage or contamination with each other, and in stationary or rotating condition.

Rotatable transfer assembly 66 is held in close proximity to the top surface of float 29, and is prevented from lifting upward from said surface, or from bouncing up and down, by a circular guide rail 68 which is rigidly se-

cured to the outer wall or skin and to the structural members of float 29. Rail 68 provides both retaining stress and arcuate guidance for a terminal connection box 67 of the rotating assembly 66 which rides upon rail 68 and is free to move arcuately on said rail around the periphery of float 29. Guide rail 68 provides the required restraining action on assembly 66 to counteract under strain when stormy seas cause excessive motion, for example, when the assembly bounces or lifts from its normal position. The guide rail also provides such counterstress as required to prevent ships high in the water from lifting assembly 66 upwardly due to the increased angle formed by a sharply inclined hawser. The mooring bar and eye is structurally supported by the frame of float 29, and is free to move and rotate without undue strain on the structure. The mooring bar and eye is shock mounted to and within the transfer assembly to prevent sudden shock or strain on said assembly while still retaining full control and responsiveness of the assembly's rotation and movement.

Terminal connection box 67 is a part of the rotating assembly 66 and is secured to and rides freely on guide rail 68. Connection box 67 is rectangular in cross section and extends arcuately with the periphery of the float, so that it can turn freely with changing position of lines 24, 26 and 28, and of hawser 30. Each of a set of pipes 56, 58 and 60 is rigidly connected to the rotatable portion 71 of the multi-chambered transfer core structure. A smooth steel plate forms a circular track 65 secured on top of float 29 on which the supporting rollers 64 of transfer assembly 66 are caused to run. It has been pointed out above that each of the lines 18, 20 and 22 is connected to its corresponding lines 24, 26 or 28. Lines 18, 20 and 22 are connected to on-shore storage tanks 10, but could be connected to an offshore drilling barge or well, or otherwise to refinery or another ship. Thus, terminal 4 provides a rotatable connection from tanks 10 or the like through the stationary portion 72, the rotatable portion 71, pipes 56, 58 and 60 to the valve connections, pipes 69, terminal connection box 67, to the ship's lines 24, 26 and 28. Therefore, when the ship is connected to the terminal for loading, discharging or bunkering it may swing or rotate around said terminal while connection box 67 follows the ships' movement. This movement correspondingly causes the entire transfer assembly 66 to move with it and the rotating portion 71 of the multi-chambered transfer core structure 80 also follows this movement, turning against the stationary portion 72 of said transfer assembly to which the stationary lines 18, 20 and 22 are connected, and which connections remain stationary and undisturbed and unaffected.

Lines 18, 20 and 22 are flexible and are installed with sufficient slack to permit rise and fall with the tide, and movement due to wave motion, wind or storm, stress and strain of the ship and other forces. Lines 24, 26 and 28 are also flexible and may be fitted with floats at intervals to keep said lines floating when filled with products which float. These may be static or pneumatic, the latter type permitting submersion of said lines when not in use. These lines may also be self-floating, requiring no buoyant devices. Lines 24, 26 and 28 may also be non-floating, and fitted with finder lines and marking buoys

and raised when ship's connection is desired. Said lines can be non-floating and arranged with several floating devices which permit submersion of sections of same, thus providing for the contraction of the overall length of lines when not in use, and removing same from sea lanes.

A marine terminal of this character may also be submerged and refloated as required, as may meet the needs of exceedingly turbulent seas experienced in some locations; or as a protective measure in time of war where the entire system may be submerged in case of enemy attack, and then refloated when "all clear" conditions again exist.

As many possible embodiments may be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinabove set forth, or shown in the accompanying drawings is to be interpreted as illustrative and not in the limiting sense.

I claim:

1. In a marine terminal, the combination of, an annular float which has an outside vertical wall at its periphery, a multi-chambered transfer assembly comprising a relatively stationary section fixed to said float and a rotatable section coupled to above stationary section, said assembly providing a plurality of separate passageways arranged for fluid transfer from a stationary connection to a rotating connection, a terminal connection box mounted on said rotatable section at the center of said float and extending radially and adapted to rotate around said float, a guide rail mounted upon said outside vertical wall and extending around the periphery of said float, means holding said connection box to said rail, means connecting each passageway of said rotating connection to said connection box and means for anchoring said float.

2. Apparatus as described in claim 1, which includes, means for connecting said terminal connection box to a ship, and a plurality of lines connecting each passageway in said assembly to the ship.

3. Apparatus as described in claim 2, wherein said terminal connection box is an arcuate structure which is pivotally supported at the center of said float by a rotatable assembly and includes means for supporting said connection box at the periphery of the float, said means also holding said connection box with limits of permissible movement around float.

4. Apparatus as described in claim 1, which includes, rollers providing for the support of said rotatable assembly, said guide rail and holding means supporting said terminal connection box close to the water level, means for providing a pivotal support for said rotatable assembly, and a plurality of lines connecting said terminal connection box to the ship.

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