Jan. 30, 1968 R. G. GIBSON 3,366,088

FLOATING OIL HARBOR

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FIG. 1

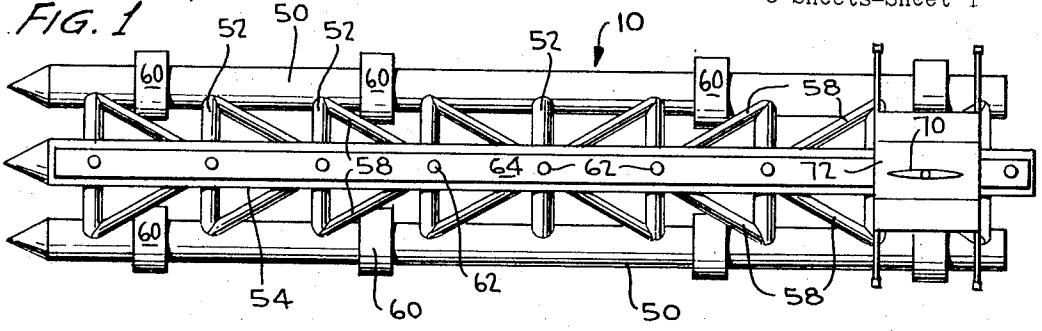

FIG. 2

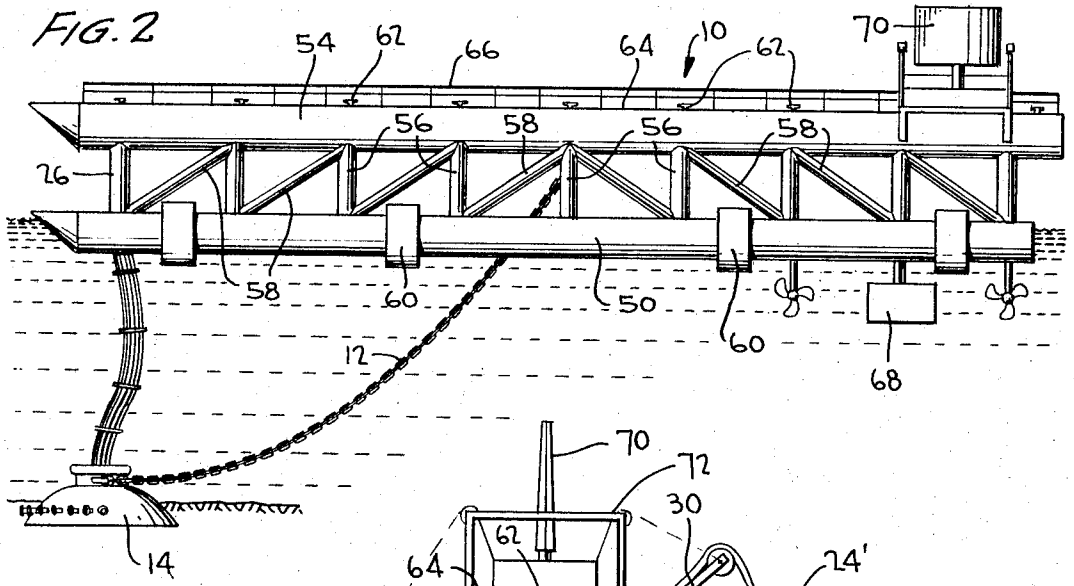

FIG. 3

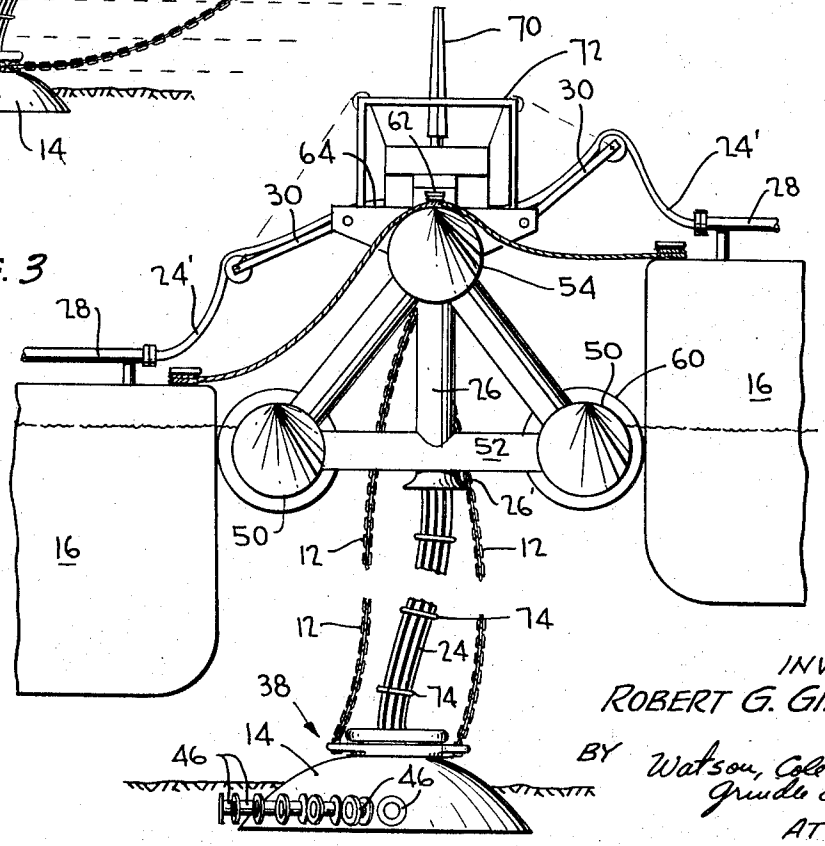

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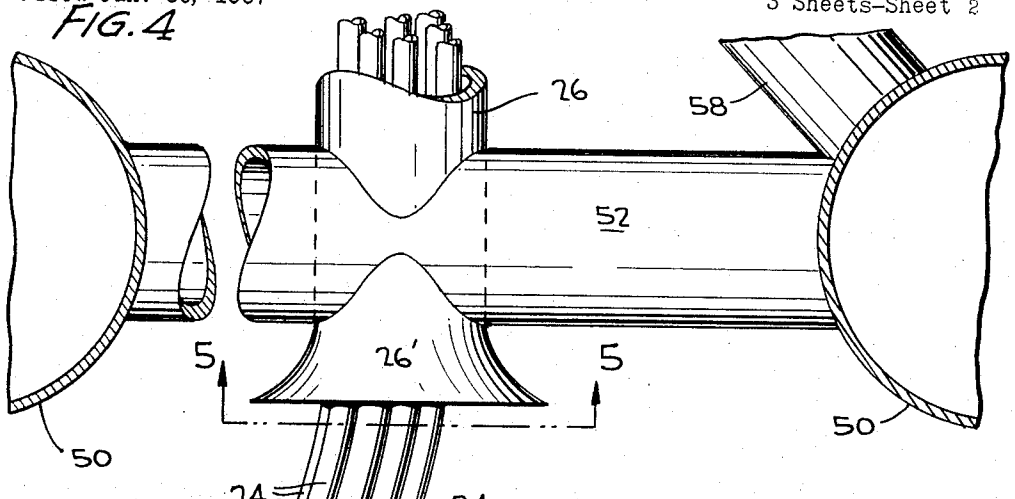
FIG. 4



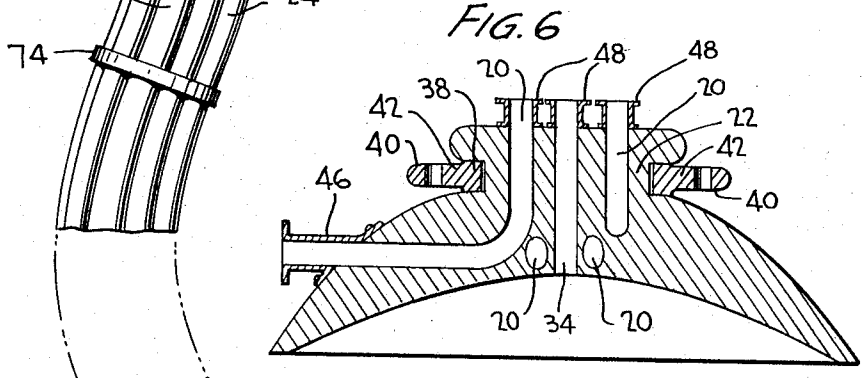


FIG. 6

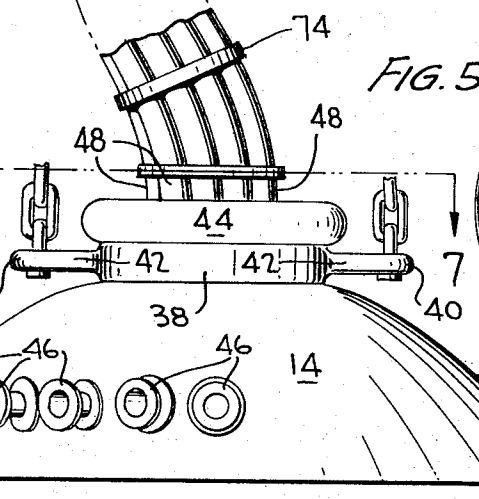


FIG. 5

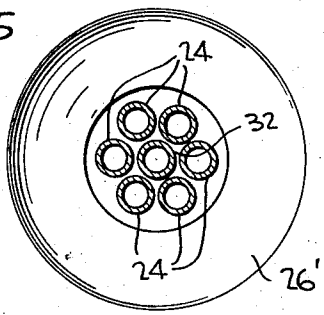


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FIG. 7

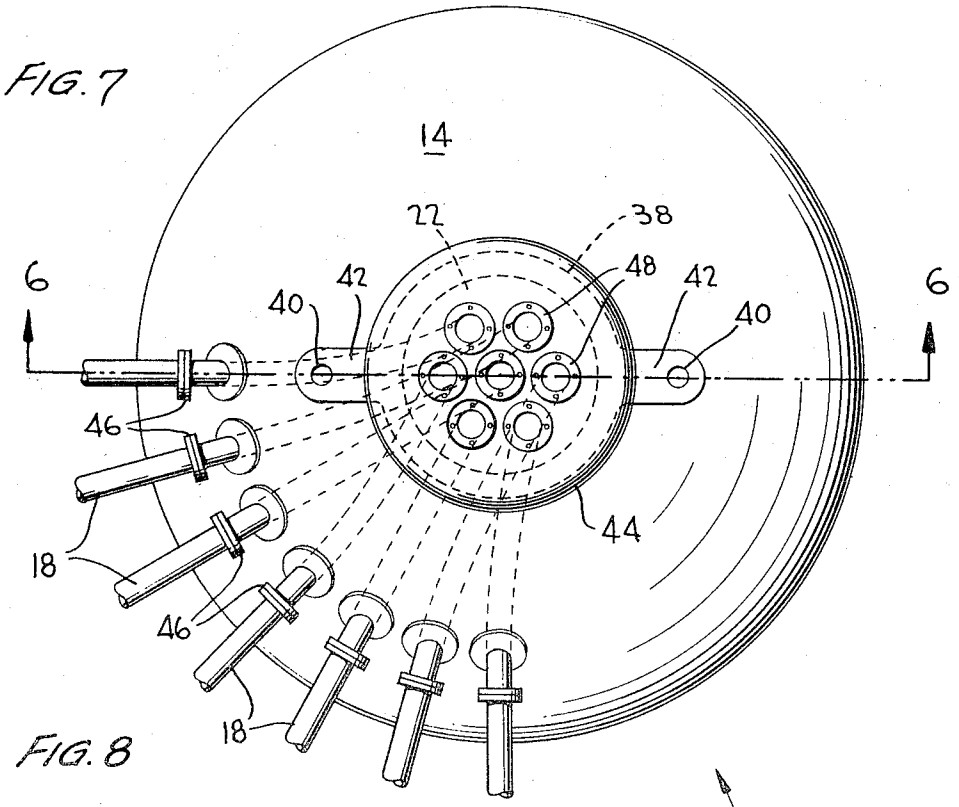
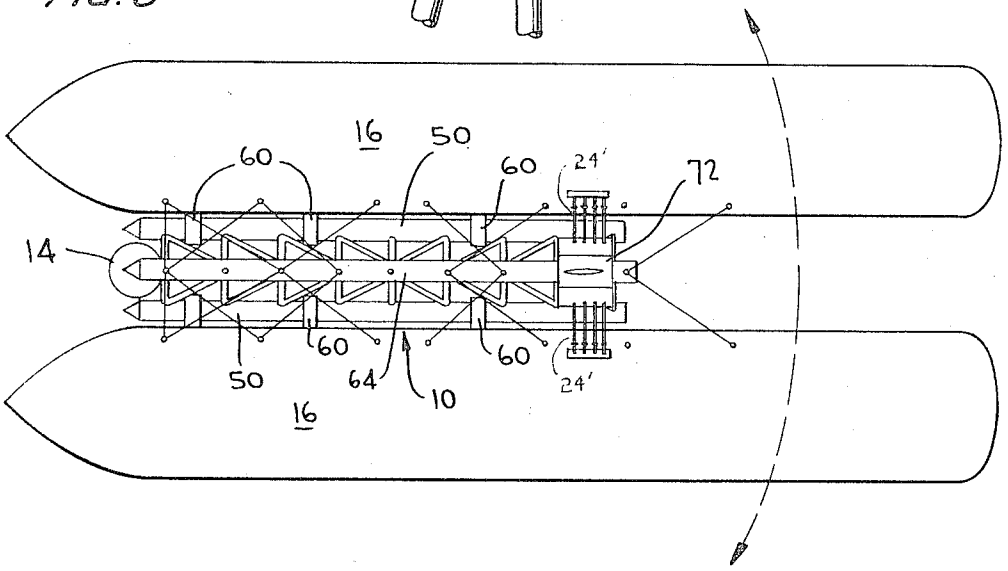


FIG. 8



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3,366,088

FLOATING OIL HARBOR

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10 Claims. (Cl. 114—230)

ABSTRACT OF THE DISCLOSURE

Disclosed herein is an elongated mooring float, adapted to have tank ships moored on either side thereof. Its anchor chain is connected to the anchor through a swivel ring rotatable about a pivot post on the anchor. Fluid passages through the anchor (each terminating in ports) open upwardly through the pivot post and laterally from the anchor respectively to interconnect fluid lines extending along the bottom with flexible hoses extending downwardly from the float at a location on the float which normally remains in substantial vertical registry with the anchor as the float and the ships moored thereto swing about the anchor as a center incident to changing wind and air currents. A further passage establishes a communication between the concave lower side of the anchor and an evacuation hose, whereby to increase the holding power of the anchor.

Summary

This invention relates to mooring and liquid transferring apparatus for tank ships and contemplates a single point anchorage together with a fluid loading and unloading arrangement allowing the ships to swing with the prevailing wind and air currents while also rising and falling freely with the tides and waves, while maintaining the anchor chains and hose lines free from entanglement with each other and without damage to the hose lines or the anchor chains by twisting.

In recent years, there has been a tendency, dictated in large part by economic reasons, to build oil tankers of increasingly larger size and draft, limited only by the depth of existing channels and the congestion of conventional ports and waterways.

The present invention contemplates an apparatus whereby the oil may be taken to or from the ships in deep water rather than to bring the ships into already congested waterways and harbors. It contemplates the opening up of open sea "oil ports" which may be located practically without limitation for servicing of various oil fields, refineries, and the like.

In accordance with the invention, there is provided a mooring float. The float is adapted to have ships moored thereto, preferably on opposite sides thereof, in such manner that the ships and the mooring float will swing together freely about an anchor on the ocean bottom to which the float is connected, so that it will remain generally radially aligned with the anchor during its swinging movement. The bow of the float preferably extends forwardly from the point of connection thereto of the anchor chain to a location over the anchor and roughly coincident with the axis about which the float swings. From this location, hoses extend downwardly for communication with passages which open upwardly through a fixed portion of the anchor which is encircled by a swivel ring which provides a rotary connection between the anchor chains and the anchor. These passages also communicate with liquid lines extending across the ocean floor from various land bases.

In accordance with a further feature, the underside of the anchor is concave and communicates with an evacuation hose, through which the holding power of the anchor may be increased.

Description of drawings

In the accompanying drawings, which illustrate a preferred embodiment of the invention:

FIGURE 1 is a plan view of the elongated mooring float;

FIGURE 2 is a side elevation of the float and of its associated anchor and hose connections;

FIGURE 3 is an enlarged end elevation of the structure shown in FIGURE 2 as seen from the left-hand end of FIGURE 2, and further includes fragmentary illustrations of tank ships moored to the elongated float;

FIGURE 4 is an enlarged detail elevational view, partially broken away, of the anchor and the liquid hose connections between the anchor and the elongated mooring float;

FIGURE 5 is a section on the line **5—5** of FIGURE 4;

FIGURE 6 is a section on the line **6—6** of FIGURE 7;

FIGURE 7 is a plan view of the anchor per se taken substantially on the line **7—7** of FIGURE 4; and

FIGURE 8 is a relatively reduced plan view of the elongated mooring buoy and its associated tank ships as illustrated in FIGURE 3.

Referring now in detail to the accompanying drawings, it will be seen by reference to FIGURES 1, 2, 3 and 8 that the illustrated structure comprises the elongated float **10** having anchor chains **12** connected to the float at a suitable location and extending to the anchor **14** which is located at a fixed point on the bottom of a body of water. The arrangement is such that the elongated float **10**, together with any ship or ships which may be moored to it, as indicated for instance at **16—16** in FIGURES 3 and 8, will swing about the anchor **14** as a center in response to the shifting air and water currents, and the longitudinal axis of the float will remain aligned with the anchor, or in other words in a substantially common vertical plane with the anchor, throughout the swinging movement. Oil or liquid conduits **18** extending from suitable delivery points and/or storage facilities on shore-based locations communicate with passages **20** respectively opening laterally outwardly through the anchor. Each of said passages **20** extends upwardly through a fixed central pivot post **22** of the anchor for communication respectively with flexible hoses **24** extending vertically upwardly and led into the mooring float through a tubular guide **26** which permits relative rotary and longitudinal movement of the hoses. The hoses **24**, in turn, extend longitudinally of the float and have their terminal ends or extensions **24'** adapted for coupling to liquid conduits **28** on the tank ships moored alongside the float, the float preferably being provided with conventional booms **30** for supporting and manipulating the free terminal end or coupling portions of these hoses.

The anchor **14** per se is shown as being circular in plan and of substantially inverted cup shape, with its lower concave surface presented toward and resting on the bottom of the body of water. Preferably, a flexible evacuation hose **32** from the float communicates through a passage **34** with the downwardly presented concavity **36** of the anchor, as shown in FIGURE 6, whereby said hose may establish communication between such concavity and a suitable evacuating pump or device (not shown) aboard the float for withdrawing air and/or water from the concavity so that the pressure of the water on top of the anchor will engage it more firmly with the bottom of the body of water. The anchor will be preferably of unitary metal construction, incorporating the upwardly projecting pivot post **22** at its center. Rotatably journaled on the post **22** is a swivel collar or ring **38** which, as best shown in FIGURES 6 and 7, has chain or anchor line connections **40**, preferably in the form of rings or eyelets, carried at the free ends of diametrically opposed and

projecting arms 42 affixed to the collar. The two anchor chains or lines 12—12, which extend downwardly from the float, have their lower terminal ends respectively connected to these eyes or eyelets 40—40 which are spaced apart sufficiently to minimize risk of entanglement of the chains with each other. It will be apparent that the collar 38 is axially positioned on the post 22 between the underlying main portion of the anchor 14 itself and an overlying radial flange 44.

The liquid conduits 18 from the various shore points are preferably fixedly coupled or connected to the laterally opening passages 20 of the anchor, as for instance by means of suitable coupling members 46 affixed to the anchor as shown in FIGURE 5. From these coupling members 46, each passage 20 through the anchor is curved to extend and open upwardly through the stationary pivot post, in the manner exemplified in FIGURE 6.

For affording a rotary coupling between each of the hoses 24 and the respective passages 20, there is provided at the upper end of each such passage a suitable flanged rotary coupling member 48 for rotary connection to a conventional rotary coupling member at the lower terminal end of its associated hose. The evacuation hose 32 is connected to its passage 34 in similar manner. From the anchor 14, the hoses extend upwardly generally vertically and are guided into the float 10 through the downwardly opening and preferably flared mouth 26' of the guide 26 which slidably receives and rotatably supports the said hoses or hose sections. The guide 26 is preferably disposed forwardly of the connection between the anchor chains 12 and the float to an extent such that it will tend to be positioned in general vertical registry with the anchor 14 itself throughout the swinging movement of the float 10 and will be subjected primarily to twisting forces on the flexible hose sections. Conventional means, not illustrated, may be provided for yieldably supporting the hoses 24 and 32 in a manner permitting the hoses to slide vertically through the guide 26 incident to rising and falling of the float 10 due to the action of waves, tides, and incident to shifting of the guide from its position of vertical registry with the anchor.

In order to adapt the float 10 for its intended function, the same is preferably formed as a catamaran (as shown in FIGURES 1, 2 and 3) to comprise a pair of generally tubular hulls 50—50 interconnected with each other in parallel relation by preferably tubular cross frame members 52. Supported above and in parallel relation to the floats is an elevated preferably tubular hull 54. In the form shown, this elevated hull 54 is supported by means of vertical tubular members 26 and 56 affixed to the mid portions of the cross members 52 as well as by the diagonal tubular members 58, such as shown in FIGURES 1, 2 and 3. The vertical tubular member 26 nearest the bow of the float has its upper end communicating with the elevated hull through the bottom thereof and also has its lower end formed, as shown in FIGURE 4, whereby it may function as the hose guide earlier described.

To provide for the mooring of tank ships 16 on either side of the elongated float 10 and in parallelism therewith, the respective elongated float hulls 50, here shown as cylindrical in conformation, are encircled by annular fenders 60 for engagement by the hulls of the respective tankers 16. Mooring bits 62 also are provided at suitable locations on the flat deck 64 of the elevated hull 54. Such hull is also preferably surrounded by a marginal railing 66 to afford safety to the crew members. The particular mode of mooring the ships to maintain them in parallelism with the elongated float may be conventional, as diagrammatically illustrated in FIGURE 8.

For insuring that the elongated float 10, together with any ships 16 moored thereto, will swing about the anchor 14 in the desired manner, with the hose guide 26 positioned substantially in registry with the anchor, the float structure may include suitable sea and air rudders 68 and 70 respectively, which will preferably be adapted for angular positioning about vertical axes in conventional manner and by conventional means (not shown) within a deck house 72 on the elevated hull.

With the arrangement illustrated, the flexible hoses 24 and 32 extending between the anchor 14 and the elongated float 10 will normally be roughly coincident with the vertical axis of swinging movement of the float and ships, and swinging of the latter will impart a twisting movement to the respective hoses, tending to twist the hoses about each other. Each individual hose, however, is free to rotate about its connection to the anchor by virtue of its rotary coupling thereto. Thus, where such a rotary coupling is provided, the hoses are relieved of any strain resulting from twisting of a given hose about its own axis. Preferably, the hoses are interconnected at suitable intervals by clips 74, as illustrated in FIGURE 2, so that their twisting movement about each other will occur in an orderly manner. Normally the flexibility and length of the hose sections will be such that they are capable of permitting a substantial degree of swinging or angular movement of the float and ships without damage. It is contemplated that, where conventional flexible hoses are utilized in accordance with the invention, the ships and float may swing for approximately 720 degrees, or through about two complete revolutions, without damage to the hose sections or entanglement with the anchor chains and without interruption to the liquid transfer operations being conducted.

After the float and ships have swung in a given angular direction for a predetermined extent, it is, of course, desirable to afford means for reversely swinging them in a manner to untwist the hose sections. For this purpose, there are provided one or more power-driven propellers 76 which may be adapted to exert sideways or lateral thrusts selectively in either direction to produce the desired swinging or angular movement. During the course of such movement, the sea rudder preferably will be positioned so as to provide the smallest possible degree of resistance. In particular, it is contemplated that the propellers are carried at the lower ends of depending standards 78 preferably constituting portions of giant outboard motors and angularly adjustable about vertical axes so that the thrust of each propeller may be exerted selectively in any desired direction.

Thus, the float 10 may be a self-propelled craft capable of movement to and from its desired station under its own power.

In the over-all operation of the invention, the float 10 may be conveyed under its own power to a desired location and anchored as above described, with the anchor chains and hose sections interconnected between the float and the anchor as shown. Ships 16 may then be moored on either side of and parallel to the float in the manner shown in FIGURES 3 and 8, and the hoses 24 may be connected to conduits 28 on the respective ships 16 to withdraw or deliver oil or other liquid. Throughout the liquid transferring operation, the float and its associated ships are free to rise and fall with variations in the water level and, if necessary, to compensate for wave action as well as for change in the draft of the respective ships resulting from charging or discharging of their respective liquid cargoes. Obviously, the arrangement here is such as to avoid the need for small boats for handling lines or hoses, and such as will permit the carrying out of liquid transferring operations, while the ships and mooring buoy swing freely about the anchor in response to changing air and water currents. Upon the completion of the loading or unloading of a given ship, the hose connections thereto are simply uncoupled, the mooring lines disconnected, and the ship is free to get under way immediately.

As will be readily apparent from inspection of FIGURE 8, the arrangement has the important advantage that the

tankers or tank ships **16—16** are presented the oil transfer hoses **24'—24'** at their conventional receiving points amidships.

Moreover, the anchor **14** constitutes a pipe line manifold or multiple coupling between the various pipe lines or conduits **18** extending over the bottom of the body of water, and the flexible hoses **24** leading to and through the mooring float for connection to ships. With this arrangement, it is possible to achieve a simultaneous flow of multiple liquids or materials notwithstanding the swinging of the ships and mooring float for multiple revolutions about the anchor, together with rising and falling thereof in response to waves, tides, and loading of cargo. It is apparent that the holding power of the anchor may be substantially enhanced by partially evacuating it through its passage **34** and evacuation hose **32**, as may be desired especially during rough weather.

Thus, the invention includes a combination anchor and coupling device or manifold per se as well as the combination thereof in novel manner with a mooring float.

Although the preferred embodiment of the invention has been illustrated and described in some detail, it will be readily apparent that various of the details may be altered or omitted, and in general, that the invention is subject to modification in various respects, all without departing from the inventive concept as expressed in the following claims.

Having thus described my invention, I claim:

1. Mooring apparatus for tank ships, comprising a submerged anchor adapted to rest on the bottom of a body of water, said anchor including a generally-cylindrical pivot post projecting upwardly therefrom and having a vertical cylindrical axis, a plurality of fluid passages through said anchor, each passage opening upwardly through said pivot post and opening laterally from the anchor at a location below said pivot post, a swivel ring journaled on the pivot post for free rotary movement about said vertical axis and for connection to a float on the surface of said body of water so that the combined actions of changing air and water currents on the float will swing same about the pivot post as a center, and flexible hoses suspended from the float and connected to the pivot post through the said ring respectively in fluid-tight communication with said passages.

2. A mooring apparatus as defined in claim **1**, including the improvement wherein said anchor is formed to define a downwardly opening cavity on its underside, and with an evacuation passage for establishing communication with a flexible evacuation hose extending from said float.

3. Mooring apparatus as defined in claim **2**, further including said float and flexible means connecting said float to the swivel ring, for angular movement of the swivel ring and float together around said pivot post and said flexible hoses.

4. Mooring apparatus as defined in claim **3**, wherein said float is elongated, and includes means for maintaining it substantially aligned with the anchor during its angular movement.

5. Mooring apparatus as defined in claim **1**, further including said float and flexible means connecting said float to the swivel ring, for angular movement of the swivel ring and float together around said pivot post and said flexible hoses.

6. Mooring apparatus as defined in claim **5**, wherein said float is elongated, and includes means for maintaining it substantially aligned with the anchor during its angular movement.

7. Mooring apparatus as defined in claim **6**, wherein said flexible means is connected to the float at a location displaced from one end thereof, said one end extending over said anchor, said hose being suspended from a location on the float substantially in vertical registry with the anchor.

8. Mooring apparatus as defined in claim **7**, including a tubular vertical guide supported at said last-mentioned location on the float, said hoses being rotatably suspended through said guide.

9. Mooring apparatus as defined in claim **1**, wherein said float is of generally rectilinear configuration, and includes means for mooring ships parallel thereto and on opposite sides thereof, for angular movement with the float.

10. Mooring apparatus as defined in claim **9**, wherein said means for maintaining the float substantially aligned with the anchor includes both sea and air rudders.

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TRYGVE BLIX, *Examiner.*