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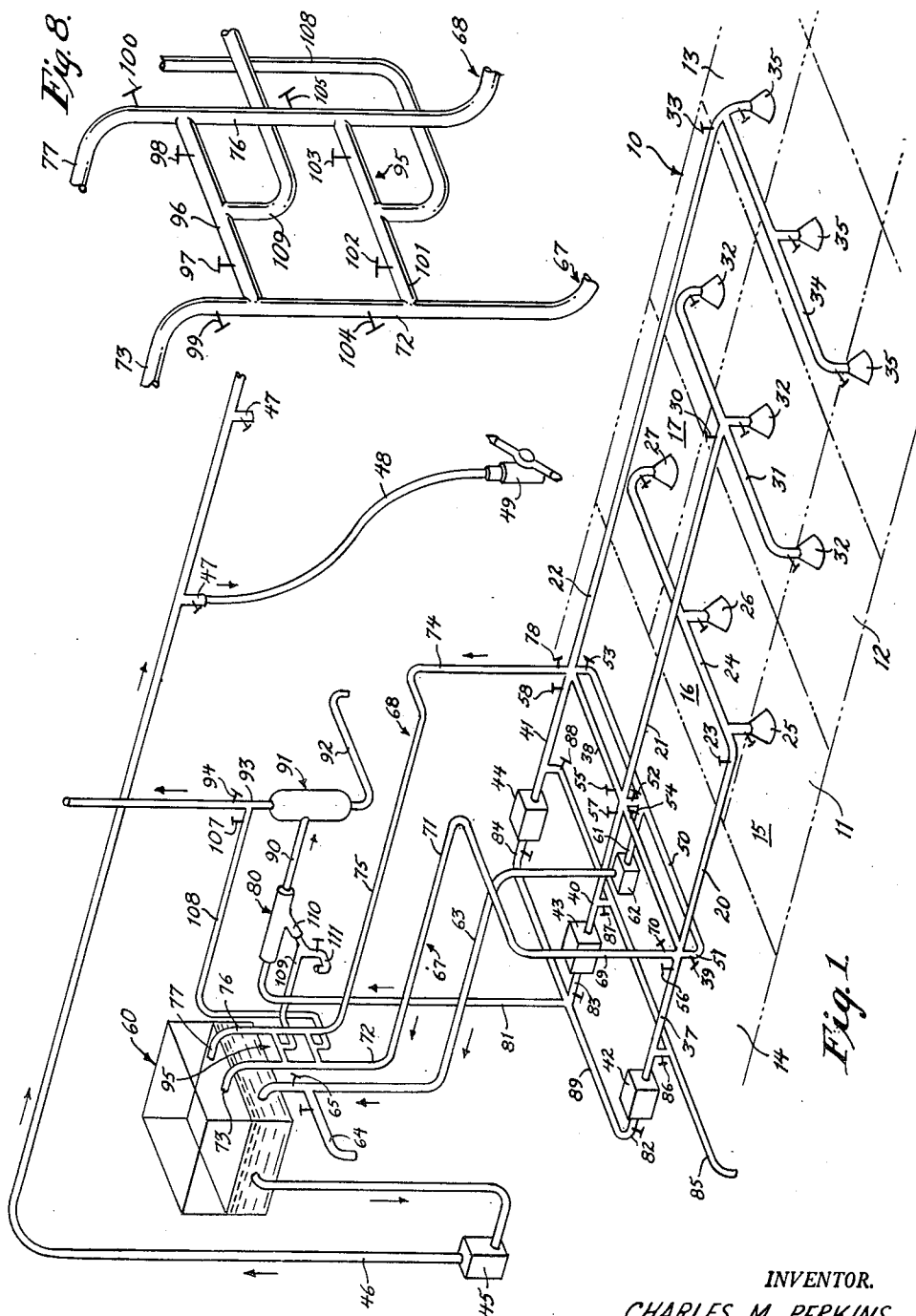
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APPARATUS FOR GAS-FREEING AND CLEANING TANKERS

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APPARATUS FOR GAS-FREEING AND CLEANING TANKERS

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This invention relates generally to the cleaning and gas-freeing of tanker ships, and embraces certain novel apparatus for employment therein.

As is well-known to those versed in the art, gas-freeing and tank-cleaning procedures on tanker ships have heretofore been extremely costly, both in time and labor. According to previous systems of gas-freeing and tank-cleaning, it was necessary to perform the operations well out at sea for reasons of safety and sanitation. This further increased the total time required. Also, prior systems of this type were extremely wasteful in discarding reclaimable cargo, as well as reusable cleaning liquid.

Accordingly, it is an object of the present invention to provide apparatus for the cleaning and gas-freeing of tanker ships wherein the operation may be performed with a considerable saving in time, at dockside if desired, and wherein the cleaning liquid is adapted to be reused, and cargo reclaimed, to effect considerable economy in the procedure.

It is another object of the present invention to provide apparatus for gas-freeing and tank-cleaning for use on tanker ships which is extremely versatile so as to be capable of operation under a wide variety of conditions, and which is entirely safe and saves considerable time and expense by being capable of performance even when a ship is under way.

It is a more particular object of the present invention to provide a gas-freeing and tank-cleaning system for tankers which utilizes the conventional tanker equipment with the addition of certain novel apparatus to achieve the above-mentioned advantageous operation.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, and combinations and arrangements of elements, which will be exemplified in the following description, and of which the scope will be indicated by the appended claims.

In the drawings:

FIGURE 1 is a diagrammatic representation of the apparatus employed in a tanker ship in practice of the present invention, including conventional equipment and certain improvements employed in conjunction therewith;

FIGURE 2 is a sectional elevational view taken through the reservoir of FIGURE 1;

FIGURE 3 is a sectional view taken substantially along the line 3-3 of FIGURE 2;

FIGURE 4 is an elevational view, partly in section, showing the ejector and separator of the apparatus of FIGURE 1;

FIGURE 5 is a sectional view taken substantially along the line 5-5 of FIGURE 4;

FIGURE 6 is a plan view, partially in section, showing a final-cleanup apparatus of the present invention in its operative condition; and

FIGURE 7 is a view similar to FIGURE 6, showing the final-cleanup apparatus in a nonuse condition.

Referring now more particularly to the drawings, and specifically to FIGURE 1 thereof, a tanker ship is there schematically represented at 10, and shown for purposes of illustration as having three sections or groups of cargo tanks 11, 12, and 13. Aft or rearward of the rear-

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most tank section 11 is the pump room 14. In the illustrated embodiment, each tank section is shown as including three tanks disposed in side-by-side relation, for example the tank section 11 including starboard tank 15, center tank 16, and port tank 17. However, the tank sections may, and usually do include more than three tanks. For purposes of terminology herein, a tank section may be considered as a group of tanks serviced by a single cargo line, as will appear presently.

Extending forward from the pump room 14 are a plurality of cargo-suction lines or pipes 20, 21, and 22, respectively corresponding to the tank sections 11, 12, and 13. That is, the cargo line 20 extends forward to the tank section 11 where it is provided with a selectively closable valve 23 and a lateral extension 24 passing into each of the tanks 15, 16, and 17 and there respectively provided with valved pickup or suction heads 25, 26, and 27. Hence, the cargo line 20 is selectively communicable with any desired one, or more, or none of the tanks in tank section 11.

Similarly, the cargo line 21 extends forward to the tank section 12, where it is provided with a selectively closable valve 30, and a lateral extension 31 having a depending, valved suction head 32 in each of the tanks of tank section 12. Also, the cargo line 22 extends forward to the tank section 13 and is there provided with a selectively closable valve 33 and extension piping 34 to the tanks of this tank section, in each tank of which the extension piping is provided with a depending, valved suction head 35. Thus, each of the cargo lines 21 and 22 is selectively communicable with any one or more, or none of the tanks in its associated tank section, 12 and 13, respectively.

In the pump room 14 is located a laterally extending crossover line or pipe 38 connected at spaced points to each of the laterally spaced cargo lines 20, 21, and 22. The cargo lines 20, 21, and 22 may each extend rearward from the pump-room crossover line 38, as at 37, 40, and 41, respectively, each rearward cargo extension being connected to a cargo pump, as at 42, 43, and 44.

An additional pump 45, such as the conventional fire pump, may be provided with a discharge line 46 extending abovedeck and provided with a plurality of valved outlet nipples 47 adjacent to the various tank sections. A hose or conduit 48 is selectively connectable to the outlets 47 of the line 46 and provided with a spraying device 49, such as Butterworth washing machine.

The apparatus described thus far in detail may be conventional, or substantially so in existing tanker ships.

At a level below or beneath the pump-room crossover 38 there may extend a laterally disposed sludge conduit or pipe 50 having upstanding valved connections 51, 52, and 53 to the pump-room crossover at its junctions, respectively, with the cargo lines 20, 21, and 22. The cargo-line crossover may be provided with a valve 54 between its connections to the cargo lines 20 and 21, and a valve 55 between its connections to the cargo lines 21 and 22. Also, valves 56, 57, and 58 may be provided, respectively, in the rearward cargo-line extensions 39, 40, and 41.

At an elevated location in the pump room 14 is positioned a cleaning-liquid vessel or reservoir generally designated 60. As the upper region of the conventional tanker pump room is empty, this provides an advantageous location for the reservoir 60. Connected to the sludge line 50 by a conduit 61, and located at substantially the same level as the sludge line, is a sludge pump 62 which has its pressure side connected by a conduit 63 to the reservoir 60. A valved branch discharge line or conduit 64 may be connected to the conduit 63 adjacent to the reservoir 60; and, a valve 65 may be connected in the conduit 63 between the discharge branch 64 and the reservoir 60.

A pair of fluid conduits, lines, or pipes, generally designated 67 and 68, extend from respective opposite ends of the pump-room crossover 38 to the reservoir or tank 60. That is, each of the conduits 67 and 68 extends from the crossover 38 to the reservoir 60, opening into the latter at an elevation spaced above the liquid level therein, as will appear more fully hereinafter. In FIGURE 1 it will be observed that the conduit 67 extends generally vertically upward in the region 69 from the end of crossover 38 adjacent to the cargo line 20, and is provided with a valve 70 adjacent to the juncture of the latter cargo line and the crossover 38. From the upper end of its generally vertical region 69 the conduit 67 may extend generally horizontally and rearward, as at 71, extending thence generally vertically upward as at 72, and terminating in a generally horizontal conduit portion 73 connected to the reservoir. Similarly, the conduit 68 includes a generally vertically disposed portion 74 extending upward from the opposite end of the crossover 38 adjacent to its juncture with the cargo line 22, and thence generally horizontally and rearward as at 75. From the rearward end of the region 75, the conduit 78 extends generally vertically upward at 76 and terminates in a generally horizontal portion 77 connected to the tank 60. The conduit 68 may have a valve 73 in its generally vertical region 74, corresponding to the valve 70 of the conduit 67.

A withdrawal means, ejector, or inductor, is generally designated 80, and may be of the type operating upon the siphon principle employing substantial velocity movement of an operating liquid. Toward this end, an operating-liquid conduit or pipe 81 is connected at its upper end to the ejector 80 to operate the latter, and is connected at its lower end through a cross pipe 89 at a plurality of valved branches or extensions 82, 83, and 84, with the high-pressure sides of the cargo pumps 42, 43, and 44, respectively. A sea-water inlet conduit or line 85 extends laterally and is connected by a valved connection to each of the cargo-line extensions 39, 40, and 41. That is, the valved connections 86, 87, and 88 respectively connect the sea-water inlet line to the cargo-line extensions 39, 40, and 41 for connection therethrough to the low-pressure or suction sides of the cargo pumps 42, 43, and 44.

Connected to the outlet of the ejector 80, as by a conduit 90 is a separator generally designated 91 for separating gases from liquids. A liquid-discharge line 92 is connected to the underside of the separator for discharging liquid overboard, or otherwise as desired. A gas-discharge line 93 is connected to the upper end of the separator 91 and extends upward therefrom for discharging the separated gases, in the manner of a stack. A valve 94 may be provided in the gas-discharge line.

Interconnecting the pair of discharge conduits 67 and 68, preferably in the region of their generally vertical portions 72 and 76 is an arrangement of valved piping, generally designated 95. This piping is best seen in FIGURE 8. It will there be observed that an upper laterally disposed conduit or pipe 96 has its opposite ends connected in fluid communication with respective pipe regions 72 and 76, and is provided adjacent to said pipe regions with respective valves 97 and 98. Also, the generally vertically extending pipe regions 72 and 76 are provided with valves 99 and 100, respectively, located between the conduit 96 and the connection regions 73 and 77 which connect to the reservoir 60.

An additional laterally disposed conduit or pipe 101 has its opposite ends respectively connected in fluid communication with the pipe regions 72 and 76, and is located vertical spaced below the conduit 96. Valves 102 and 103 are provided in the conduit 101 respectively adjacent to the pipe regions 72 and 76; and valves 104 and 105 are provided in the pipe regions 72 and 76, respectively, between the conduits 101 and 96.

Referring again to FIGURE 1, it will be noted that a

branch conduit 108 is connected between the gas-discharge conduit 93 of the separator 91 and the medial region of the lower lateral conduit 101, between the valves 102 and 103. A valve 107 may be provided in the branch conduit 108.

Extending from a medial region of the upper laterally disposed conduit 96, between its valves 97 and 98 is an additional conduit 109 which has its other end connected to the suction or gas inlet 110 of the ejector 80. A valved branch line 111 may be connected to the conduit 109.

In FIGURES 2 and 3 are shown details of the reservoir 60, which includes a vessel or tank 113 having an upper end closure or lid 114, which may be hinged, as at 115 to one wall of the tank for opening and closing movement relative thereto. Contained in the tank 113 is a quantity of cleaning liquid 116, which may be fresh water, heated or cold, preferably containing a detergent or other suitable cleaning agent. Also illustrated in the tank 113 is a layer of reclaimed oil 117, or the like, stratified above the level of the cleaning liquid 116. Heating means 118, say a steam-heating coil or otherwise, may be provided interiorly of the tank 113 for heating the cleaning liquid 116.

It will be noted that the pair of conduits 67 and 68 enter the tank 113 through their connection regions 73 and 77 in laterally spaced relation above the level of liquids contained in the tank. A generally vertical separating plate or baffle 120 may be fixed interiorly of the tank 113 between the connections therewith of the connecting conduit regions 73 and 77. Also, a pair of downwardly deflecting baffles 121 and 122 may be mounted interiorly of the tank 113, each disposed obliquely in front of the opening of a respective conduit connecting region 73 and 77 into the tank. The deflecting baffles 121 and 122 may be carried by the tank top wall or lid 114, as by brackets 123 and 124.

The upper end region 125 of the sludge line 63 is connected to the tank 113 and opens into the latter below the level of the cleaning liquid 116. Also connected to the tank 113, preferably above the bottom wall and below the level of the cleaning liquid 116 is the upper end of an intake conduit 126 having its lower end connected to the low-pressure side of the pump 45.

In FIGURES 4 and 5 are seen the ejector or eductor 80 and the liquid-gas separator 91. The ejector is illustrated as being of the liquid-operating, aspirating type having an operating-liquid inlet 128 connected to the upper end of the conduit 81 from the cargo pumps. The gas inlet 110 of the ejector 80 is connected to the conduit 109, and the outlet 129 of the ejector, for the egress of operating liquid and entrained gas, is connected through the conduit 90 to the liquid-gas separator 91.

The separator 91 may include a generally vertical cylinder 130 having an internal helical vane 131 extending about its internal wall surface. The conduit 90 is connected tangentially to the cylindrical chamber 130 for entry therein beneath the helical vane 131. The lower end of the chamber 130 opens through the liquid-discharge conduit 92, while the upper end of the chamber opens through the gas-discharge conduit 93. In operation, the relatively heavy liquid is impelled centrifugally outward by the tangential entry through conduit 90 into the chamber 130, and directed downward toward the outlet or discharge conduit 92, while the relatively light gas, having considerably less centrifugal force, passes centrally upward from the chamber 130 through the outlet 93.

A cargo line, say the cargo line 20, is shown enlarged in FIGURE 6, and there provided with a nipple 133 having an end flange 134, and provided with a closure valve 135. A manifold fitting, generally designated 136, includes a trunk pipe 138 and a plurality of branch pipes or nipples 139 extending from the trunk. The distal ends of the branch pipes 139 may be provided with removable closure plugs 140. One end of the trunk conduit 138 is removably insertable into the nipple 133, and provided

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with an external peripheral flange 141 which cooperates with the nipple flange 134 to sandwich therebetween a sealing gasket 142.

A flexible suction hose 143 has one insertable into the distal end of a branch 139 when its plug 140 has been removed. The insertion end of the suction hose 143 may be provided with an external collar 144 to limit its insertion into the respective branch 139; and, the opposite end of the suction hose may be provided with an intake head 145.

When the manifold suction fitting 136 is not in use, the nipple 133 may be closed by an end plate 146 bolted in covering relation to the flange 134, as seen in FIGURE 7.

In operation, cleaning liquid is pumped from the reservoir 60, through the conduit 126, pump 45, conduit 46, a selected nipple 47, and through the hose 48, to the Butterworth washing device 49 which is suspended in a tank to be cleaned for washing the latter. Simultaneously, one or more of the cargo pumps 42, 43, and 44 pass operating liquid, such as sea water from the intake conduit 85 through the selected cargo pump or pumps, and subsequently through the conduit 81 and into the ejector 80. The liquid passes through the ejector and its outlet conduit 90 to the separator 91. This passage of liquid through the ejector 80 creates a vacuum at the gas inlet 110. This vacuum is transmitted through the line 109 and piping 95, and thence through a selected one of the conduits 67 and 68 and the proper cargo line for applying suction to and withdrawing material from the tank being washed. It is believed obvious that either of the pair of conduits 67 and 68 may be connected to any tank in any tank section by proper manipulation of valves in the pump-room crossover 38 and in the cargo lines. The material withdrawn from the tank being washed includes the cleaning liquid, reclaimable oil, and sludge including rust and the like, as well as gases or vapors in the tank. By reason of the elevation of the ejector 80 above the level of the cargo lines, and the vertically extending regions 69 and 74 of the conduits 67 and 68, the liquids and solids withdrawn from a tank being washed are not elevated appreciably, if at all, into the conduits 67 and 68, but rather fall into the sludge conduit 50. From the sludge conduit 50, the solids or muck is pumped through the muck pump 62 and the conduit 63 into the reservoir 60, where it settles out and may easily be removed, if desired. Alternatively, the sludge or muck may be pumped through the conduit 63 and discharged overboard through the conduit 64, by proper operation of the valves associated with these conduits.

However, the gaseous material withdrawn from the tank being washed is sucked up through the particular conduit 67 or 68 in fluid communication with the tank, and through the piping means 95 and conduit 109 to the gas inlet 110 of the ejector, where it becomes entrained in the liquid operating the ejector. The ejector-operating liquid and gases entrained therein are passed to the separator 91 for separation of the gases from the liquids, the latter being discharged overboard through conduit 92. The gases may then be discharged upward through the stack or conduit 93 to the atmosphere, or recirculated through the branch conduit 108, piping means 95, and the other one of the conduits 67 and 68 to a desired tank. This recirculation of withdrawn gases is highly advantageous especially when the tank from which the gases are being withdrawn has cooled down so that the gases are relatively cool and clean. These relatively cool and clean gases may then be passed to a later or more recently washed tank to displace the relatively hot gas vapors in a more recently or later-washed tank and expel the hotter gases and vapors upward out of the tank. Of course, as soon as the first tank is washed by the Butterworth machine, the machine may be transferred to another tank for washing. The second-washed tank is preferably in a different section of tanks so that the relatively cool and clean gases withdrawn from the first-washed

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tank may be passed to the second-washed tank immediately following washing. Relatively cool and clean gases may be passed to the first-washed tank during washing of the second tank by means of the air-inlet conduit 111. That is, opening of the valved conduit 111 will pass fresh air into entrainment with the ejector-operating liquid for separation therefrom and recirculation to the first-washed tank, in the manner described above.

When a tank is sufficiently cool and gas-free, a final cleanup may be accomplished by men entering into the tank and employing the apparatus of FIGURE 6 to suck remaining dirt and scale into the cargo lines for withdrawal to the muck pump and subsequent passage to the reservoir 60. This may be performed immediately following the introduction of relatively cool and clean gas into a washed tank.

Of course, the above-described procedure is repeated with all of the tanks; and, the manner of operation is highly versatile for use under all possible conditions.

If it is desired, the final cleanup operation may be accomplished without the apparatus of FIGURE 6, say by men shoveling the dirt and scale into a bucket connected to the cargo line.

After all tanks are cleaned, the pipe lines may be washed with cold or hot water, and detergent if desired, which is returned to the reservoir 60 by the muck pump 62, and fresh air is drawn through the cargo lines for complete gas-freeing. This washing of the pipe lines may be accomplished with the main cargo pumps at relatively high speed to insure that all scale is removed from the lines and valves.

In the reservoir, it will now be appreciated that the sludge or muck settles to the bottom, while the reclaimable oil rises to the top, for easy removal.

Referring now in detail to the operation of the piping means 95 in FIGURE 8, it is apparent that suction is applied through the line 109 to a medial region of the conduit 96, which suction may be selectively transmitted through either of the conduits 68 and 67, and thereby applied to a selected tank. Also, gas discharged from the separator 91 may pass through the branch conduit 108 to a medial region of the lateral conduit 101 for recirculation through the other of the conduits 67 and 68 to another tank. Also, if desired, the withdrawn gases may be passed through the reservoir 60, say if heavier material is being sucked up in the suction line 67 or 68, for its downward deflection into the reservoir by one of the baffles 121 and 122, to prevent the passage of such heavier material to the ejector 80. Obviously, an extremely high degree of versatility is afforded by the apparatus of the present invention to accomplish its intended objects under all conditions of use.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention and scope of the appended claims.

What is claimed is:

1. Apparatus for gas-freeing and cleaning the tanks of a tanker ship having cargo lines connected to the respective tanks, cleaning means for introducing cleaning liquid into said tanks, and pump means connected to each of said cargo lines and cleaning means, said apparatus comprising: a reservoir for cleaning liquid adapted for connection to said cleaning means; a pair of fluid conduits each connected between said reservoir and said cargo lines for selective communication therebetween; suction-producing means having an inlet and an outlet and connected at its inlet to said pair of conduits for selective communication therewith to withdraw solids, liquids, and gases from a selected tank and located at an elevation sufficient to receive the withdrawn gases but not the withdrawn solids and liquids; branch conduit means connected between the outlet of said suction means and said pair of conduits for selectively discharging the withdrawn gases to the

atmosphere or one of said pair of conduits; and additional pump means connected to said cargo lines and reservoir for selectively passing said withdrawn solids and liquids to said reservoir or overboard.

2. Apparatus according to claim 1, said suction-producing means comprising an ejector connected to said pump means for operation by sea water, said withdrawn gases being received by said sea water.

3. Apparatus according to claim 2, in combination with liquid-gas separating means having an inlet for the sea water and entrained gas and having a pair of outlets for separated liquids and gases respectively, said separating means having its inlet connected to the outlet of said ejector for receiving liquids and gases therefrom and having its gas outlet connected to said branch conduit.

4. Apparatus according to claim 1, said reservoir comprising a closed vessel adapted to contain a cleaning liquid having its level spaced below the upper end of the vessel, said pair of conduits being connected to said vessel at the upper region thereof spaced above the cleaning-level liquid for the passage of withdrawn gases through said vessel between said pair of conduits.

5. Apparatus according to claim 4, the connection of said additional pump means to said vessel being adjacent to but below the cleaning-level liquid therein.

6. In apparatus for gas-freeing and cleaning the tanks of a tanker ship having cargo lines connected to the respective tanks, the combination comprising: a reservoir; a pair of fluid conduits each connected at one end to said reservoir and having its other end adapted for con-

nection to said cargo lines; eductor means having an inlet and an outlet; first fluid-passageway means between said pair of conduits and the inlet of said eductor for selective communication of the latter with said pair of conduits; a discharge conduit connected to the outlet of said eductor for discharge to the atmosphere; and a second fluid-passageway means between said pair of conduits and the outlet of said eductor for selective communication of the latter with said pair of conduits and said discharge conduit; whereby material withdrawn from any of said tanks is adapted to be selectively passed to another of said tanks, said reservoir, or said discharge conduit.

7. The combination according to claim 6, said eductor comprising a siphon adapted to be operated by sea water for withdrawing material from said tanks; and a liquid-gas separator interposed in fluid communication between said siphon and discharge conduit.

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