

5 A METHOD OF PREPARING A TANK SHIP

This invention relates to a method of preparing a tank ship. More particularly, it relates to a method of preparing a tank ship for sand transportation and fluidized unloading.

10 When filling in sea areas in order to gain land, oftentimes large amounts of mass are required. According to prior art, so-called self-unloading dredgers TSHD ("Trailing Suction Hopper Dredgers") are commonly used. During the transport from the loading site to the unloading site, the mass is located in silo-like compartments in the vessel. The mass may be unloaded by opening the bottom of the vessel, for example by virtue of the hull being formed in two parts structured in a manner allowing them to be moved
15 relative to each other.

EP-document 0677618 discloses a vessel having bottom hatches.

However, vessels of the type mentioned are not particularly suitable for carrying large quantities of mass over longer distances and not, in particular, when transportation across open sea areas comes into question. The reason for this is related to economy,
20 given that these vessels are relatively expensive to build and operate, and also due to their relatively limited carrying capacity.

It is known to fluidize the mass before and during unloading. As such, US patent 3445008 describes a method and device wherein the lower portion of the hold of the vessel is filled with water prior to pumping out water and mass.

25 It is known, from US patent 4033470, to use nozzles and water under pressure to fluidize the cargo.

Transportation of mass in holds generally requires that the hold must be closed, and that the cargo must be classified as dry during transportation in the open sea.

The object of the invention is to remedy or reduce at least one of the disadvantages of

the prior art.

In accordance with the invention, the object is achieved by virtue of the features disclosed in the following description and in the subsequent claims.

5 A method of preparing a tank ship for sand transportation and fluidized unloading is provided, wherein the method comprises disposing within a cargo tank, fluidizing pipes having inflow openings and also a slurry inlet for fluidized sand, wherein the method further include connecting a slurry pump between the slurry inlet and an unloading pipe.

10 The unloading pipe may be routed over the deck or through the bottom or side of the tank ship.

A tank ship, being an oil tanker, a product tanker or any other ship designed for bulk transport of liquids, has several cargo tanks divided by bulkheads. When carrying sand, full load capacity of the tank ship is achieved by filling sand in only a number of the cargo tanks. These tanks are below termed sand cargo tanks. The redundant cargo tanks are below termed redundant cargo tanks.

The slurry pump may be placed in a redundant cargo tank adjacent to a sand cargo tank.

The method may further include disposing a slurry inlet in a bulkhead between a sand cargo tank and a redundant cargo tank.

20 Thus slurry may be unloaded from a sand cargo tank of the tank ship without having to substantially alter the layout of the vessel.

The method may further include disposing, in a redundant cargo tank adjacent to a sand cargo tank, a water pump to be connected between a water inlet and a fluidizing pipe.

25 By virtue of disposing the pumps in an redundant cargo tank, the pumps are located at a level of height near the floor of the sand cargo tank. The slurry pump may also be positioned near the slurry inlet. This reduces cavitation which would otherwise take place at a substantial degree in the pumps. The outflow of slurry to the slurry pump is facilitated by virtue of the static pressure from the sand, which is located above the slurry in the utility hold, creating a pressure on the slurry.

30 During unloading, water may flow in from the water inlet and through the inflow open-

ings, which may comprise nozzles, so as to fluidize the sand located closest to the floor of the sand cargo tank – frequently termed the tank top. If desirable, fluidizing pipes having inflow openings may also be disposed on the walls of the sand cargo tank, or at different levels of height in the sand cargo tank.

5 In order to further improve the fluidizing of the sand, the method may also include disposing air injection pipes in the sand cargo tank, preferably near the floor thereof. The air injection pipes may be provided with air injection openings, such as nozzles. The air injection pipes are connected to a compressor, typically via a pressure tank. Experiments have proven that water-fluidized sand obtains better fluidity by virtue of
10 mixing some air into the fluidized sand.

As stated above, a tank ship may not be filled up with sand in all the cargo tanks, given that the carrying capacity of the tank ship then would be exceeded. For this reason, it is also appropriate to use e.g. every other cargo tank as a redundant cargo tank for technical equipment which, in addition to the pumps and a compressor, may
15 comprise valves and control components.

In order to be able to adjust the specific gravity of the fluidized sand before entering into the slurry pump, injection pipes for water to the slurry pipe may also be disposed on the inlet side of the slurry pump. The water may be supplied from the water pump or from a sea chest in the hull of the tank ship.

20 In general, the equipment in one redundant cargo tank may serve two adjacent sand cargo tanks.

The fluidized sand may be unloaded by allowing it to flow into the slurry inlet and onwards via the slurry pump and the unloading pipe.

The method may further comprise to let the unloading pipe end outside the tank ship
25 when the sand is to be unloaded from the tank ship, or connecting the unloading pipe to a transport pipe when the fluidized sand is to be delivered at a distance from the tank ship, for example onshore.

A ship for transportation of sand is normally loaded with fluidized or very wet sand, typically excavated from the seabed near the loading site. The sand must be drained
30 in order to be classified as dry during the transport.

The method may comprise disposing at least one drainage column for drainage of the sand in the sand cargo tank. A drainage column of this type may comprise a pipe hav-

ing a number of openings in the pipe wall along the pipe, each opening being screened in such a way that water may enter through the opening, whereas settled sand covers the screen and thus prevent significant quantities of sand from entering into the drainage column.

- 5 The method may further comprise connecting the drainage column to the slurry pump for pumping out water from the surface of the sand.

The use of a tank ship preferably having at least three cargo tanks and prepared in accordance with the invention for transportation of sand across the open sea allows for a substantial reduction in time and costs for transportation and unloading of sand.

- 10 An example of a preferred method and embodiment is described in the following and is depicted in the accompanying drawings, where:

Fig. 1 shows, in cross-section, a tank ship in accordance with the invention during loading;

Fig. 2 shows a plan view of a segment of the cargo tanks of the tank ship;

- 15 Fig. 3 shows, in perspective, details of a sand cargo tank of the tank ship, wherein the extent of the sand cargo tank is indicated by means of dashed lines; and

Fig. 4 shows, on a larger scale, a section through a drainage column.

- In the drawings, the reference numeral 1 represents a tank ship comprising several cargo tanks, here utilized as at least one redundant cargo tank 2 and sand cargo tank 4.
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In fig. 1, the tank ship 1 is moored next to a dredger 6, where sand in fluidized form flows from the dredger 6 and into the sand cargo tank 4 via a filling pipe 8.

- The sand cargo tank 4 of the tank ship 1, near the floor - tank top - thereof, is provided with a number of fluidizing pipes 10 having inflow openings 12. The fluidizing pipes 10 extend horizontally in the longitudinal direction of the tank ship 1 and are connected to a manifold 14. Via a first water valve 16, the manifold 14 is connected to a water pump 18 that receives water from a water inlet 20, see figure 2. The water inlet 20 may comprise a sea chest (not shown). The water pump 18 is positioned in a redundant cargo tank 2 adjacent to the sand cargo tank 4 and is designed in a manner allowing it supply water, via a second water valve 22, to another adjacent sand cargo
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tank 4. In figure 2, the second water valve 22 is hidden underneath the water pump 18.

A portion of the fluidizing pipes 10 is placed on the walls 24 of the sand cargo tank 4.

5 A number of air injection pipes 26 having air injection openings 28 are disposed near the floor of the sand cargo tank 4. The air injection pipes 26 communicate with a pressure tank 30 located in an adjacent redundant cargo tank 2 relative to the sand cargo tank 4.

10 In a bulkhead 32 between the redundant cargo tank 2 and the sand cargo tank 4, a slurry inlet 34 is positioned. Via the slurry inlet 34 and a slurry valve 36 the sand cargo tank 4 is connected to the inlet of a slurry pump 38. The slurry pump 38, which is placed in a redundant cargo tank 2 adjacent to the sand cargo tank 4, is connected to an unloading pipe 40. The unloading pipe 40 ends in the sea next to the tank ship 1.

15 An intermediate pipe 42 is connected between the manifold 14 and the inlet of the slurry pump 38. The aim is to be able to adjust the specific gravity of the fluidized sand before entering into the slurry pump 38 by supplying additional water via the intermediate pipe 42.

20 Three drainage columns 44 are disposed in the sand cargo tank 4. The drainage columns 44 are connected, at their lower portions, to a drainage pipe 46 which, via a drainage valve 48, is connected to the slurry pump 38.

The drainage columns 44 comprise a pipe 50 having a number of openings 52 in the pipe wall along the longitudinal extent thereof, see figure 4. A screen 54, which is tight at the top and open at the bottom, surrounds the pipe 50 at the openings 52, whereby an annular space 56 is formed between the screen 54 and pipe 50.

25 Water may flow into the annular space 56 and onwards into the pipe 50 via the openings 52, whereas sand settling around the screen 54 will seal the annular space 56 at the bottom as the sand cargo tank 4 is being filled. Excess water 58 located above the sand 60, see figure 1, must therefore exit via openings 52 higher up on the drainage column 44.

30 During loading of the tank ship 1, when fluidized sand flows into the sand cargo tank 4 via the filling pipe 8, the sand 60 settles in the sand cargo tank 4. The slurry valve 36 is closed and the drainage valve 48 is open. As described above, the excess water 58

is drained via the drainage columns 44, drainage pipe 46 and slurry pump 38 and into the sea via the unloading pipe 40.

Before unloading of the tank ship 1 is to take place, the first water valve 16 is opened, the drainage valve 48 is closed, and the slurry valve 36 is opened.

- 5 Upon starting the water pump 18, water flows from the water inlet 20 and via the water pump 18, the first water valve 16, the manifold 14, the fluidizing pipes 10 and the inflow openings 12 and into the sand 60, whereby the part of the sand located closest to the inflow openings 12 is fluidized and forms a slurry.

- 10 Upon starting the slurry pump 38, the fluidized sand flows via the slurry inlet 34, the slurry valve 36 and the slurry pump 38 onto the unloading pipe 40.

If desirable, air is supplied to the fluidized sand from the pressure tank 30 via the air injection pipes 26 and the air injection openings 28.

C l a i m s

1. A method of preparing a tank ship (1) for sand transportation and fluidized unloading, c h a r a c t e r i z e d i n that the method includes:
 - disposing fluidizing pipes (10) having inflow openings (12) and also a slurry inlet (34) for fluidized sand, within a sand cargo tank (4); and
 - connecting a slurry pump (38) between a slurry inlet (34) and an unloading pipe (40).
2. The method in accordance with claim 1, c h a r a c t e r r i z e d i n that the method further includes disposing the slurry pump in a redundant cargo tank (2) adjacent to the sand cargo tank (4).
3. The method in accordance with claim 1, c h a r a c t e r r i z e d i n that the method further includes disposing a slurry inlet (34) in a bulkhead (32) between cargo tanks (2, 4).
4. The method in accordance with claim 1, c h a r a c t e r i z e d i n that the method further includes disposing, on the tank ship (1), a water pump (18) to be connected between a water inlet (20) and the fluidizing pipe (10).
5. The method in accordance with claim 1, c h a r a c t e r i z e d i n that the method further comprises: disposing fluidizing pipes (10) having inflow openings (12) on the wall (24) of the sand cargo tank (4).
6. The method in accordance with claim 1, c h a r a c t e r i z e d i n that the method further comprises: disposing air injection pipes (26) in the sand cargo tank (4).
7. The method in accordance with claim 1, c h a r a c t e r i z e d i n that the method further includes letting the unloading pipe (40) discharge at the tank ship (1).
8. The method in accordance with claim 1, c h a r a c t e r i z e d i n that the method further comprises: connecting the unloading pipe (40) to a conveying pipe.
9. The method in accordance with claim 1, c h a r a c t e r i z e d i n that the method further comprises: disposing at least one drainage column (44) in the sand cargo tank (4).

10. The method in accordance with claim 7, c h a r a c t e r i z e d i n that the method further comprises: connecting the drainage column (44) to the slurry pump (38).
11. Use of a tank ship (1) prepared in accordance with claim 1 for transportation of sand across the open sea.