United States Patent

Laarman

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[54] HOPPER CRAFT

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[51] **Int. Cl.**.....**B65g 53/30**

[58] **Field of Search**.....302/17, 15, 27, 28, 59; 141/35; 214/15 B; 37/58

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Assistant Examiner—Merle F. Maffei
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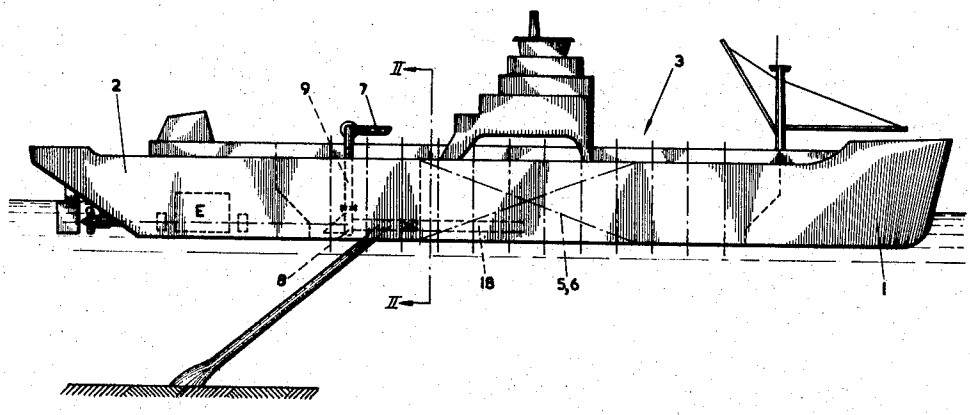
[57] **ABSTRACT**

A hopper craft is adapted to be loaded with relatively light material such as mud or with relatively dense material such as mixtures of sand and gravel. A central hopper is provided with air chambers on either side, and loading means selectively direct the load into the central hopper and/or the air chambers. The central hopper overflows into the air chambers and the air chambers overflow to the sea; while alternatively, the central hopper can overflow directly to the sea. The central chambers are used for any type of material but the air chambers are used only for light material.

3 Claims, 4 Drawing Figures



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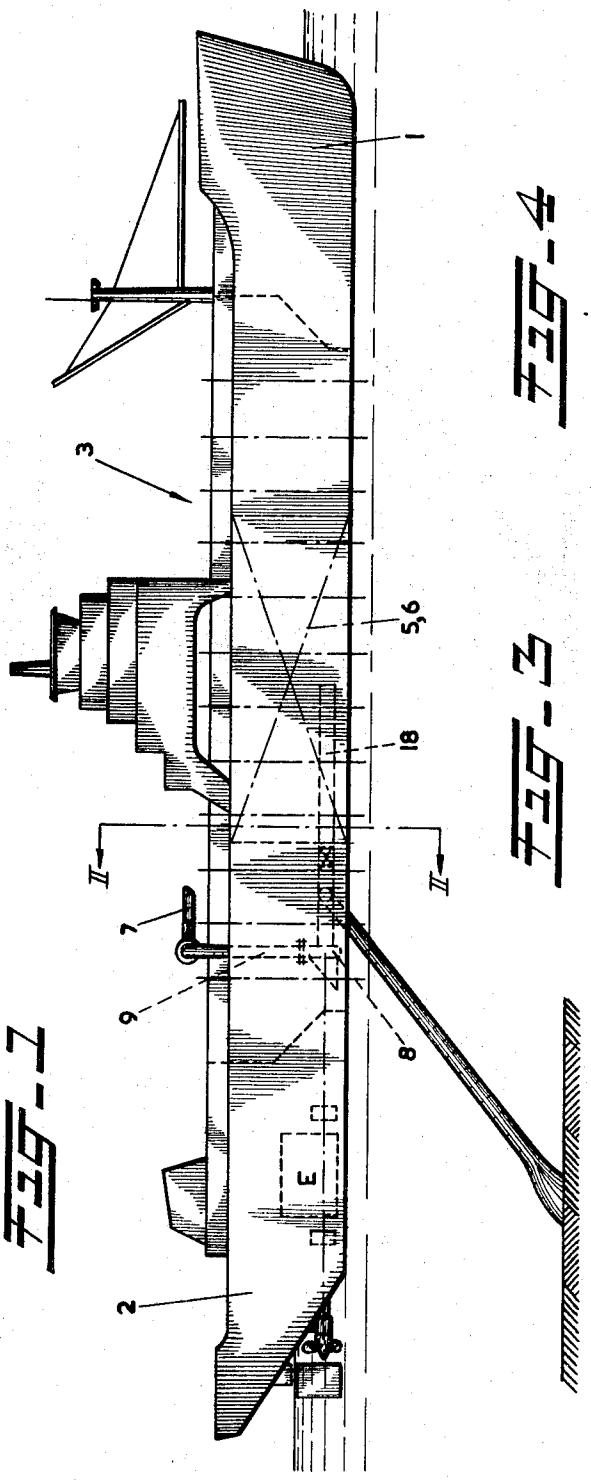

FIG. 7

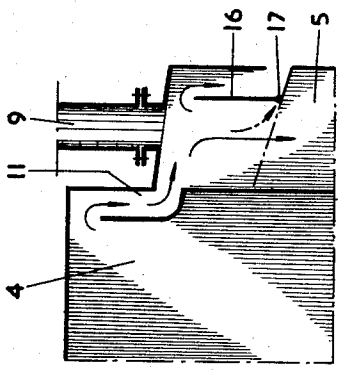

FIG. 4

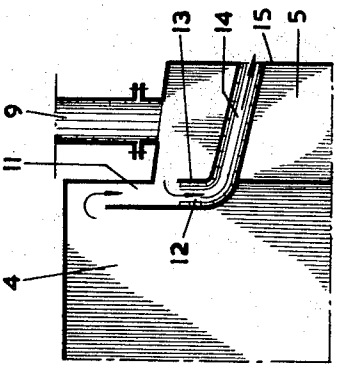

FIG. 3

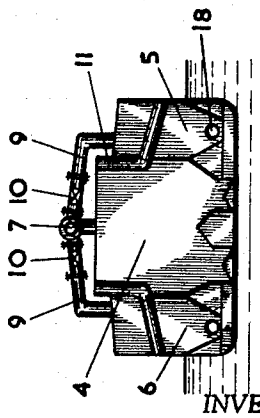

FIG. 2

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HOPPER CRAFT

The invention relates to a hopper craft which has been provided with one or more hoppers, situated at a central position along the sides of the craft, as well as "air chambers".

Such a craft is adapted to carry, and afterwards unload, dredged soil, and may or may not be a self-propelled "box", a stationary dredge with a pump, a tow dredge with a pump, or the like.

A hopper craft is usually dimensioned in such a way that the volume of the central hopper corresponds with the most customary specific gravity of the material to be carried. The specific gravity of the load, however, varies greatly, ranging from about 1.2 for mud, to 2.2 for a solid mixture of sand and gravel. The estimated specific gravity of sand is about 1.8, and as dredged material usually consists of sand, a hopper craft is generally constructed to carry material having a specific gravity of about 1.8. Thus, if mud has to be carried, the vessel is carrying a considerably lighter load than is permitted by its buoyancy.

If it should be desired to transport a greater load of mud, there is a possibility of increasing the level of the overflow of the central hopper, but this affects the stability of the craft.

The hopper craft might be dimensioned for a lower specific gravity than that of sand, so that a better loading limit is provided for mud, but the circumstance arises that when loading heavy material at a certain stage a weight has been reached at which the central hopper is only partially filled with material, and the water-line of the craft is so high that an overflow has become impossible. In this case there is still a considerable quantity of water above the material, said water forming a dead weight.

It is the object of the invention to solve this problem.

According to the invention the hopper craft has been provided with means for loading the air chambers with the material to be carried and unloading said material from the air chambers.

Thus, the craft is constructed in such a way that with a maximum load of material having a high specific gravity nearly all the excess water can still flow away, the overflow of said hopper being adapted to be raised to such a level that the stability of the hopper craft is not affected when the hopper is loaded with material having a average specific gravity. If light material has now to be loaded, the hopper is loaded to a level which corresponds with a volume having the specific gravity of average sand, while the air chambers are then loaded with the light material (mud, for example).

This makes for a better use of the maximum carrying capacity of the hopper barge, while in addition to this the stability of the vessel is improved by loading the air chambers when the load consists of mud.

The means for loading the air chambers with the material to be carried may consist of branched pipes of the chute for the central hopper, which chute may be valve controlled, said branched pipes naturally being valve controlled and debouching into the air chambers, and being spaced over one or more locations.

The lateral overflows of the central hopper may also flow directly into the air chambers, which overflows may be short-circuited overboard when loading heavy material.

A direct connection between the overflow of the central hopper and the outboard side may be effected, for instance, by means of valves which seal the air chambers at the upper side. It goes without saying that other constructions may be thought of for discharging the overflow straight overboard.

Flap doors may be provided for unloading the air chambers, but it is also possible for every air chamber to be connected to the suction pipe of a pump by means of which the air chambers may be pumped dry.

With this arrangement the load can be distributed in the central hopper and the air chambers in a proper way, and this with the aid of the vertically adjustable overflow of the central hopper, and by using the air chambers as holds to a lesser or greater extent. This makes it possible to carry a minimum

quantity of water as a dead load with material of widely varying specific gravity ranging between the limits customary in practice of about 1.2 and 2.2.

Some preferred embodiments of the invention are diagrammatically illustrated in the accompanying drawing.

FIG. 1 shows diagrammatically a longitudinal view of a hopper craft constructed as a tow dredge pump.

FIG. 2 shows a cross-section through the craft on the line II—II in FIG. 1.

FIG. 3 shows diagrammatically an embodiment of the invention on an enlarged scale for loading the air chambers.

FIG. 4 shows another construction of the embodiment according to FIG. 3.

Along the sides of the vessel the hopper craft roughly consists of a forecastle **1**, a stern **2**, and a centre part **3**. The center part **3** athwartship is constructed in three parts. It has a central hopper **4** with air chambers **5** and **6** on either side thereof. A pressure pipe **7** leading from a dredge pump **8** is arranged in a central position and in a longitudinal direction above the central hopper **4**. Branch pipes **9** leading from the pressure pipe **7** have been provided with stop valves **10**, said branch pipes **9** debouching into the air chambers **5** and **6**. The central hopper **4** has been provided with an overflow **11** on either side, said overflow emptying straight into the sea. The overflow of the air chambers is not shown in the drawing.

FIG. 3 shows an embodiment in which the overflow **11** of the central hopper **4** debouches into a pipe **12**, the overflow **13** of the air chamber **5** also debouching into this pipe **12**. The pipe **12** leads via pipes **14**, across the air chamber to and out through the ship's hull **15**.

If light material has to be carried in a craft according to this embodiment, the central hopper and the air chambers are filled via the pipe **7** with a greater or lesser number of stop valves **10** being in open position until their level of overflow has been reached when the water escapes. This process is repeated until the desired, generally maximum, loading capacity of the craft has been attained.

FIG. 4 shows an embodiment in which no extra pipes **9** need be provided, which pipes debouch into the air chambers. Loading takes place via the central pipe **7** in the central hopper, and once the central hopper has been filled to capacity, the suspension automatically flows to the air chambers **5** and **6** via the overflow **11**. In the air chamber **5** have been provided valves **16** pivotally arranged around horizontal axes **17**. If material with an average to high specific gravity is loaded in the central hopper, the valve **16** are lowered, and the overflow will flow right across the valve **16** (illustrated with dotted lines in FIG. 4) into the water. If mud is to be loaded, the valves **16** are raised, forming an overflow for the air chamber **5** and **6** respectively. This gives the mud overflowing from the central hopper **4** into the air chamber **5** the chance to settle, the water then flowing off to the outside over the valve **16**.

It goes without saying that there are other conceivable solutions for loading the air chambers in the desired way.

As the air chambers generally will only be used if mud, i.e. free flowing material is to be loaded, there is a pipe **18** for the discharge of the mud from the air chambers **5** and **6** on the bottom of each of the air chambers (FIGS. 1 and 2), said pipe being adapted to communicate with a pump, which is the dredge pump **8** in the example in question. The pipe **18** may, for example, lead in a longitudinal direction to a position midway of the air chamber.

A craft having a loading capacity of 9,000 tons may serve as an example.

Estimated at a specific gravity of 2.2 the volume of a pay load is: 4,200 m^3, with a specific gravity of 1.8: 5,000 m^3, and with a specific gravity of 1.2: 7,500 m^3.

The craft is constructed in such a way according to the invention that the overflow is complete, or substantially complete with a load of 4,200 m^3 of material having a specific gravity of 2.2, said volume for complete overflow being adapted to be raised to a volume of 5,000 m^3, the acceptable stability of the craft remaining intact if this volume is filled

with material having a specific gravity of at most 1.8. For material having a specific gravity ranging from 2.2 to 1.8 the overflow should be adapted to a corresponding height. Thus, only the central hopper is loaded with a load having a specific gravity in the range of between 2.2 1.8.

However, if lighter material has to be loaded, such as material having a specific gravity of 1.2, the central hopper is filled with 5,000 m^3, and the air chambers with 2,500 m^3 of mud.

For a load having a specific gravity in the range of between 1.8 and 1.2 the level of overflow of the central hopper is lowered, as a result of which there is no need for water to be carried in the air chambers.

The embodiment in which the overflow of the central hopper opens directly into the air chambers has the additional advantage, with respect to the arrangement in which the air chambers are loaded directly, that the heaviest material settles in the central hopper, because of which stones and the like will therefore not get into the air chambers.

I claim:

1. A hopper craft for dredged soil and water, comprising a buoyant hull having at least one central hopper therein and at least two air chambers therein disposed one on either lateral

side of the craft with the central hopper between them, means for loading dredged soil and water into said central hopper, means for selectively loading dredged soil and water into said air chambers, means for removing dredged soil and water from the bottom of said central hopper, means for removing dredged soil and water from the bottom of said air chambers, overflow means by which water from said central hopper overflows by gravity into said air chambers, and means for selectively preventing said overflow from said central hopper into said air chambers and for directing said overflow from said central hopper overboard of said craft.

2. A craft as claimed in claim 1, said selective directing means comprising means swingable between a lowered position in which said means direct overflow from the central chamber to the sea, and a raised position in which said means permit overflow of said central chamber to said air chamber.

3. A craft as claimed in claim 2, said selective directing means in said raised position comprising an overflow means from said air chambers overboard of said craft, the last-named overflow means being substantially lower than the overflow means between the central chamber and the air chambers.

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