

SAND DISCHARGE SYSTEM AND METHOD FOR LONG DISTANCE DISCHARGING SAND IN A HIGH SAND-CONTENT MIXTURE

Field of the Invention

[0001] The present invention generally relates to sand discharge from sand-loaded ships, and more particularly to a sand discharge system for long-distance discharging sand in a high sand-content mixture from sand-loaded ships, and further to a method for sand discharge.

Background of the Invention

[0002] The current sand-unloading method for discharging sand from a sand transportation ship generally includes: unloading sand in batches to conveying ships by excavators, conveyor belts or the like, and transporting the sand to a sand depot for storage. When needed to be used, the sand is transported into designated applied locations by a cutter suction dredger, a trailer suction dredger or pumps, or loaded onto the conveying ships that transport the sand into the designated applied locations. The current method has the following disadvantages:

[0003] (1) The sand-unloading procedure is cumbersome complex, needing to load/unload the sand two or more times; it not only requires a great deal of labor forces and material resources, but also takes long time to complete the procedure. Furthermore, the sand depot needs a large space.

[0004] (2) The sand-unloading process is discontinuous, low efficient and redundant; it incurs unnecessary expenses, increasing the production cost.

[0005] (3) The conveying ships with various sizes are shuttled within a confined and crowded area; it gravitates environment pollution, enhances the safety risks, increases management difficulties and affects the progression of projects.

[0006] (4) The discarding, spraying, dropping and leaking of the sand during the process of projects will lead an irregular seabed within the area; thus the safety of ships cannot be guaranteed.

[0007] For these reasons, the total amount of unloaded sand is limited, the progression of projects is slowed down, and the production costs are increased.

Summary of the Invention

[0008] Therefore, one objective of the present invention is to provide a sand discharge system and method for continuous and long-distance discharge of sand from a sand-loaded transportation ship.

[0009] One aspect of the present invention provides a sand-discharging system. In one embodiment, the sand-discharging system comprises a sand mortar making module for mixing sand and water to make a sand mortar for long distance transportation; a funnel; a sand extracting pump; and water supply means for supplying water to the sand mortar making module, funnel and sand extracting pump; wherein the sand mortar making module has a sand mortar making chamber disposed within a sand and water mixing means, a water receiving port for receiving water, a sand receiving port for receiving sand from the funnel, and a sand mortar discharging port for discharging the sand mortar to the sand

extracting pump; wherein the funnel receives sand to be transported and then supplies to the sand mortar making module by a releasing passage and a sand release controller that is disposed in the way of the releasing passage or between the releasing passage and the sand receiving port; wherein the releasing passage and the sand receiving port have an inclined configuration so as to allow smooth release of the sand from the funnel into the sand mortar making chamber of the sand mortar making module; and wherein the sand extracting pump is couple at one end with the sand mortar discharging port and at the other end with a sand mortar conveying pipeline; thereby the sand extracting pump extracts the sand mortar from the sand mortar making module from the sand mortar discharging port and transports the sand mortar by the sand mortar conveying pipeline to a designated location.

[0010] In another embodiment of the sand-discharging system, the water supply means is a water supply pump; wherein the water supply pump is coupled at one end with a water receiving passage, and at other end with a bifurcated water releasing port with a first end directly coupled with the water receiving port of the sand mortar making module and a second end directly coupled with a funnel water supply passage; thereby the water supply pump supplies water to both the sand mortar making module and funnel. In a further embodiment of the sand-discharging system, the water-supply pump is an SH pump, and the sand extracting pump is a LQ submersible mortar pump and LH booster.

[0011] In another embodiment of the sand-discharging system, the sand mortar conveying pipeline is a macromolecular polyethylene pipe.

[0012] In another embodiment of the sand-discharging system, the water supply means includes a water supply valve that is coupled at one end with a first water receiving passage and at the other end with the water receiving port of the sand mortar making

module, and a water supply pump that is coupled at one end with a second water receiving passage and at the other end with a funnel water supply passage; so that the water supply valve supplies water into the sand mortar making module and sand extracting pump, and the water supply pump supplies water into the funnel. In a further embodiment of the sand-discharging system, the water supply valve is disposed at a position that is lower than water level; so that the water can enter the water supply valve without external power supply.

[0013] In another embodiment of the sand-discharging system, it further comprises a carrier providing support for installing the sand mortar making module, funnel, sand extracting pump, and water supply means. In a further embodiment of the sand-discharging system, the carrier is a bulk cargo carrier, flat barge, platform or dock.

[0014] In another embodiment of the sand-discharging system, it further comprises one or more floaters for supporting the sand conveying pipeline in water.

[0015] Another aspect of the present invention provides a process for transporting sand over a long distance. In one embodiment, the process comprises securing a carrier installed with the sand-discharging system to the side of a sand conveying ship in parallel; starting the water supply means and sand extracting pump so as to supply water into the sand mortar-making module and funnel, then into the sand extracting pump; unloading sand from the sand conveying ship into the funnel; releasing the sand from the funnel into the sand mortar-making module through the sand automatic controlling valve, where the sand mortar-making module mixes the sand and water to make the sand mortar; and transporting the sand mortar to a designated location through the sand conveying pipeline by the sand extracting pump.

[0016] In yet another aspect, there is provided another sand-discharging system having two or more sand mortar making modules mixing sand and water to make a sand mortar for long distance transportation, wherein each of the two or more sand mortar making modules has a sand groove located at its bottom and a sand mortar pump disposed onto its bottom for mixing the sand and water from the sand groove; a funnel with two or more discharge channels receiving sand from an external source, wherein each of two or more discharging channels supplies sand to each sand groove of one of the two or more sand mortar making modules; two or more water supply valves controlling the water supply to the sand groove of the sand mortar making modules, wherein each of the two or more water supply valves is coupled to a water passage that takes water from an external source and delivers to the sand groove of the sand mortar making modules; and wherein in operation, the water supply valves are disposed at a position that is lower than the water level; so that the water can enter the water supply valves without external power supply; a water supply pump supplying water to the funnel, wherein the water supply pump is coupled at one end with a water receiving passage and at the other end with a funnel water supply passage, and wherein the funnel water supply passage provides water above the funnel so as to dilute and lubricate the sand; and a sand conveying pipe transporting sand mortar to a designated location, wherein the sand conveying pipe has two or more branches at the proximal end so that each branch is coupled to each sand mortar pump.

[0017] In one embodiment, each of the two or more discharging channels is equipped with one automatic controlling valve for controlling the volume of sand to be discharged. The water-supply valves may be a water automatic controlling valve.

[0018] In yet a further aspect, there is also provided a sand mortar making module for mixing sand and water to make a sand mortar for long distance transportation, the sand

mortar making module comprises a sand and water mixing means having a sand mortar making chamber disposed therein; a water receiving port adapted at one end of the sand and water mixing means for discharging water into the sand mortar making chamber; a sand mortar discharging port adapted at an opposing end of the sand and water mixing means for discharging the sand mortar out from the sand mortar making chamber; a sand receiving port adapted at a upper side of the sand and water mixing means for receiving sands; and an inclined surface disposed directly beneath the sand receiving port across the sand mortar chamber, wherein the inclined surface inclines towards the sand mortar discharging port. Operationally the sand receiving port receives sand and discharged towards the inclined surface, the inclined surface provides a smooth release of the sand into the end of sand mortar making chamber, wherein the water supplies through the water receiving port enters into the sand mortar making chamber,

[0019] In one embodiment, the sand receiving port is connected to the sand and water mixing means to form a T-junction join. In another embodiment, the sand receiving port is incline oriented so that the port is facing toward the sand mortar discharging port.

[0020] The objectives and advantages of the invention will become apparent from the following detailed description of preferred embodiments thereof in connection with the accompanying drawings.

Brief Description of the Drawings

[0021] Preferred embodiments according to the present invention will now be described with reference to the Figures, in which like reference numerals denote like elements.

[0022] **FIG 1** shows a schematic illustration of the sand-discharging system in accordance with one embodiment of the present invention;

[0023] **FIG 2** shows a schematic illustration of the sand-discharging system installed in a carrier in accordance with one embodiment of the present invention;

[0024] **FIG 3** shows a schematic illustration of the sand-discharging system in an operation mode in accordance with one embodiment of the present invention;

[0025] **FIG 4** shows a schematic illustration of the sand-discharging system in accordance with another embodiment of the present invention;

[0026] **FIG 5** shows a schematic illustration of the sand-discharging system installed in a carrier in accordance with another embodiment of the present invention;

[0027] **FIG 6** shows a schematic illustration of the sand-discharging system in an operation mode in accordance with another embodiment of the present invention; and

[0028] **FIG 7** shows a schematic illustration of the sand-discharging system in accordance with one embodiment of the present invention.

[0029] **FIG 8** shows a schematic illustration of the sand-discharging system installed in a carrier in accordance with one embodiment of the present invention.

[0030] **FIG 9** shows a schematic illustration of the sand-discharging system in an operation mode in accordance with one embodiment of the present invention.

Detailed Description of the Invention

[0031] The present invention may be understood more readily by reference to the following detailed description of certain embodiments of the invention.

[0032] Throughout this application, where publications are referenced, the disclosures of these publications are hereby incorporated by reference, in their entireties, into this application in order to more fully describe the state of art to which this invention pertains.

[0033] Referring now to **FIG 1**, there is provided a schematic illustration of the sand-discharging system in accordance with one embodiment of the present invention. The sand-discharging system **1** comprises a sand mortar making module **2**, a funnel **3**, a water supply pump **4**, and a sand extracting pump **5**. It is to be noted that many conventional electric, electronic and mechanic means and operations are intentionally omitted from the description and drawings in order not to obscure the principles of the present invention. The inventors believe that such omissions will not impede one in the art to understand and practice the present invention.

[0034] The sand mortar making module **2** mixes sand and water to make a sand mortar for long distance transportation. In one embodiment, the sand mortar making module **2** has a sand mortar making chamber **24** disposed within a sand and water mixing means such as a blade-type mixer, a water receiving port **21** for receiving water from the water supply pump **4**, a sand receiving port **22** for receiving sand from the funnel **3**, and a sand mortar discharging port **23** for discharging the sand mortar to the sand extracting pump **5**. In certain embodiments, the water-supply pump **4** may be a SH pump, and the sand extracting pump **5** may a LQ submersible mortar pump and LH booster.

[0035] The funnel **3** receives sand from an external source (discussed herein below) and then supplies to the sand mortar making module **2** in a controlled manner. The funnel

3 is coupled with a releasing passage **31**, and a sand release controller **32** that disposed in the way of the releasing passage or between the releasing passage and the sand receiving port **22**. In one embodiment, the releasing passage **31** and the sand receiving port **22** have an inclined configuration so as to allow smooth release of the sand from the funnel **3** into the sand mortar making chamber **24** of the sand mortar making module **2**. More specifically, the releasing passage **31** and the sand receiving port **22** are inclined towards the sand mortar discharging port **23**. In certain embodiments, the sand release controller **32** is a sand automatic controlling valve that is controllable by automatic control signals (the means for realizing the automatic control signals are well known in the art). The sand release controller **32** controls the quantity and speed released based on the quality of sand.

[0036] As illustrated in **FIG 1**, the sand mortar making module **2** is a hollow tube having the water receiving port **21** at one end and a sand mortar discharging port **23** disposed on an opposing end. The hollow space of the tube defines the sand mortar making chamber **24**. The sand receiving port **22** connects to the hollow tube in the inclined manner as mentioned, which allows the sand discharged from the funnel to naturally flow towards the direction of the sand discharging port **23**. The sand mortar discharge chamber **24** has a slide surface **25** directly beneath the opening of the sand receiving port **22**. The slide surface **25** is also inclined in a similar direction toward the sand discharging port **23**. The configuration of the slide surface **25** allows the sand discharged through the sand receiving port **22** be directed towards the sand discharged port **23**. Underneath the slide surface **25** is left as an empty space or path, which allows water from the water receiving port **21** to flow through the path towards the sand discharged port **23**. Operationally, sand that discharged through the sand receiving port **22** and the water from the water receiving port **21** are mixed together beyond the sliding surface. As the chamber **2** is relatively

larger than the receiving ports **21** and **22**, it provides a sufficient space for mixing the sand and the water into mortar before it is discharged through the sand discharging port **23**.

[0037] The water supply pump **4** provides water supply to the sand mortar making module **2** and funnel **3**. The water supply pump **4** is coupled at one end with a water receiving passage **41** that is usually liquid coupled with the water below the sand-discharging system, and at other end with a bifurcated water releasing port with a first end directly coupled with the water receiving port **21** and a second end directly coupled with a funnel water supply passage **42**; thus the water supply pump **4** can supply water to both the sand mortar making module **2** and funnel **3**. The funnel water supply passage **42** provides water above the funnel **3** so as to dilute and lubricate the sand, which is expected to let the sand have a smooth flow from the funnel **3** into the sand mortar-making module **2**. The water supply can be controlled by any conventional means.

[0038] The sand extracting pump **5** extracts sand mortar from the sand mortar making module **2**. The sand extracting pump **5** is coupled at one end with the sand mortar discharging port **23** and at the other end with a sand mortar conveying pipeline **51**. The sand mortar conveying pipeline **51** can have variable length depending upon the distance between the sand discharging system and a designated location. In certain embodiments, the sand mortar conveying pipeline **51** is a macromolecular polyethylene pipe.

[0039] It would be desired that sand flow sensor (not shown) is installed at the downstream of the sand mortar making module **2** to determined if the sand is flowing at a desired rate. The sensor feeds the signal to a center controller (not shown) which may control the valve **32** and/or the water supply pump **4** to provide a desired mixture ratio of the sand from the funnel **3** and the water from the water supply pump **4** to ensure a smooth flow of the discharging sand.

[0040] Referring now to **FIG 2**, there is provided a schematic illustration of the sand-discharging system installed in a carrier **6** in accordance with one embodiment of the present invention. The carrier **6** provides supporting platform for installing the sand mortar making module **2**, funnel **3**, water supply pump **4** and sand extracting pump **5**. The sand conveying pipeline can be supported by floaters **52**. The carrier **6** can be a bulk cargo carrier, flat barge, platform or dock.

[0041] Referring now to **FIG 3**, there is provided a schematic illustration of the sand-discharging system in an operation mode in accordance with one embodiment of the present invention. The carrier **6** is positioned in parallel to a sand transportation ship **7**, where the sand transportation ship **7** is equipped with a crane **8** and a sand belt feeder **9**. The sand from the sand transportation ship **7** is unloaded by the sand belt feeder **9** onto the funnel **3**. The means and operation of unloading sand from the sand transportation ship **7** onto the sand belt feeder **9** are well known in the art.

[0042] There is now provided a brief description of the sand unloading and transportation process by the operation of the sand-discharging system as shown in **FIG 3** in accordance one embodiment of the present invention. The sand unloading and transportation process comprises:

[0043] (1) the sand conveying ship **7** is anchored after arriving at a designated location, and the carrier **6** which is installed with the sand-discharging system is closely paralleled and fixed with the ship;

[0044] (2) start the water supply pump **4** (e.g., SH pump) and sand extracting pump **5** (e.g., LH pump), where the water supply pump **4** supplies water into the sand mortar-making module **2** and funnel **3**, then into the sand extracting pump;

[0045] (3) begin to unload sand from the sand conveying ship 7; the sand belt feeder 9 is started and the sand is unloaded into the funnel 3;

[0046] (4) release the sand from the funnel 3 into the sand mortar-making module 2 through the sand automatic controlling valve, where the sand mortar-making module 2 mixes the sand and water to make the sand mortar; and

[0047] (5) after the mortar is finished, it is transported to the designated location through the pipeline 51 with the sand extracting pump.

[0048] Referring now to **FIG 4**, there is provided a schematic illustration of the sand-discharging system in accordance with another embodiment of the present invention. The sand-discharging system 100 comprises a sand mortar making module 110, a funnel 120, a water supply valve 130, a sand extracting pump 140, and a water supply pump 150. The major difference between the sand-discharging system shown in **FIG 1** and the sand-discharging system shown in **FIG 4** is the water supplies to the sand mortar making module and funnel.

[0049] The sand mortar making module 110 mixes sand and water to make a sand mortar for long distance transportation. In one embodiment, the sand mortar making module 110 has a sand mortar making chamber 114 disposed within a sand and water mixing means such as a blade-type mixer, a water receiving port 111 for receiving water from the water supply valve 130, a sand receiving port 112 for receiving sand from the funnel 120, and a sand mortar discharging port 113 for discharging the sand mortar to the sand extracting pump 140. In certain embodiments, the water-supply valve 130 is a water automatic controlling valve, and the sand extracting pump 140 is a LQ submersible mortar pump and LH booster.

[0050] The funnel **120** receives sand from an external source (discussed hereinbelow) and then supplies to the sand mortar making module **110** in a controlled manner. The funnel **120** is coupled with a releasing passage **121**, and a sand release controller **122** that disposed in the way of the releasing passage or between the releasing passage and the sand receiving port **112**. In one embodiment, the releasing passage **121** and the sand receiving port **112** have an inclined configuration so as to allow smooth release of the sand from the funnel **120** into the sand mortar making chamber **114** of the sand mortar making module **110**. In certain embodiments, the sand release controller **122** is a sand automatic controlling valve that is controllable by automatic control signals (the means for realizing the automatic control signals are well known in the art). The sand release controller **122** controls the quantity and speed released based on the quality of sand.

[0051] The water supply valve **130** controls the water supply to the sand mortar making chamber **114**; it can be any suitable controllable valve. The water supply valve **130** is coupled to a water receiving passage **131** and the water receiving port **111** of the sand mortar making module **110**. As discussed below, the water supply valve **130** is disposed at a position that is lower than the water level; thus the water can enter the water supply valve **130** without external power supply.

[0052] The sand extracting pump **140** extracts sand mortar from the sand mortar making module **110**. The sand extracting pump **140** is coupled at one end with the sand mortar discharging port **113** and at the other end with a sand mortar conveying pipeline **141**. The sand mortar conveying pipeline **141** can have variable length depending upon the distance between the sand discharging system and a designated location. In certain embodiments, the sand mortar conveying pipeline **141** is a macromolecular polyethylene pipe.

[0053] The water supply pump **150** provides water supply to the funnel **120**. The water supply pump **150** is coupled at one end with a water receiving passage **151** and at the other end with a funnel water supply passage **152**. The funnel water supply passage **152** provides water above the funnel **120** so as to dilute and lubricate the sand, which is expected to let the sand have a smooth flow from the funnel **120** into the sand mortar-making module **110**. The water supply can be controlled by any conventional means.

[0054] Referring now to **FIG 5**, there is provided a schematic illustration of the sand-discharging system installed in a carrier in accordance with another embodiment of the present invention. The carrier **160** provides a support for installing the sand mortar making module **110**, funnel **120**, water supply valve **130**, sand extracting pump **140**, and water supply pump **150**. The sand conveying pipeline can be supported by floaters **142**. The carrier **160** can be a bulk cargo carrier, flat barge, platform or dock. The sand mortar making module **110**, water supply valve **130**, sand extracting pump **140**, and water supply pump **150** are disposed within the carrier **160** at a position lower than the water level.

[0055] Referring now to **FIG 6**, there is provided a schematic illustration of the sand-discharging system in an operation mode in accordance with another embodiment of the present invention. The carrier **160** is positioned in parallel to a sand transportation ship **170**, where the sand transportation ship **170** is equipped with a crane **180** and a sand belt feeder **190**. The sand from the sand transportation ship **170** is unloaded by the sand belt feeder **190** onto the funnel **120**. The means and operation of unloading sand from the sand transportation ship **170** onto the sand belt feeder **190** are well known in the art.

[0056] There is now provided a brief description of the sand unloading and transportation process by the operation of the sand-discharging system as shown in **FIG 6**

in accordance one embodiment of the present invention. The sand unloading and transportation process comprises:

[0057] (1) the sand conveying ship **170** is anchored after arriving at a designated location, and the carrier **160** which is installed with the sand-discharging system is closely paralleled and fixed with the ship;

[0058] (2) start the water supply valve **130**, sand extracting pump **140**, and the water supply pump **150**, where the water supply valve **130** supplies water into the sand mortar-making module **110** and then into the sand extracting pump **140**, and the water supply pump **150** supplies water into the funnel **120**;

[0059] (3) begin to unload sand from the sand conveying ship **170**; the sand belt feeder **190** is started and the sand is unloaded into the funnel **120**;

[0060] (4) release the sand from the funnel **120** into the sand mortar-making module **110** through the sand automatic controlling valve, where the sand mortar-making module **110** mixes the sand and water to make the sand mortar; and

[0061] (5) after the mortar is finished, it is transported to the designated location through the pipeline **141** with the sand extracting pump.

[0062] The present invention has many advantages over conventional sand-unloading methods. The advantages include:

[0063] (1) The unloaded sand can be transported to a more distant targeted location; thus reducing the intermediate links used in conventional barge transportation, increasing work efficiency, and cutting down the cost of unloading sand;

[0064] (2) More than one set of the sand-unloading systems can be used to simultaneously unload sand from multiple cabins or decks of one sand conveying ship;

thus reducing the time of unloading sand, and at the same time shortening the anchorage time of the sand conveying ship;

[0065] (3) There are requirements of the water depth in the reclamation area; sand can be transported to more distant shoal water area or land, which eliminates the risk of being stranded that is caused by traditional direct cast;

[0066] (4) The appliances and pipelines of this system are installed and operated in a sealed environment, which avoids water pollution and do not affect the seabed where the ships are anchored or the regular work of ships.

[0067] The above embodiments illustrated various sand-discharging systems adapting one funnel for illustrations only, not limitation. A sand-discharging system according to further embodiments of the present invention may adapt a plurality of funnels, and the sand discharging means for discharging sands efficiently.

[0068] Referring now to **FIG 7**, there is provided a schematic illustration of the sand-discharging system in accordance with one embodiment of the present invention. The sand-discharging system 7 comprises two or more sand mortar making modules 72, a funnel with two or more discharge channels 73, two or more water supply valves 74, a water supply pump 75, and a sand conveying pipe 76. It is to be noted that many conventional electric, electronic and mechanic means and operations are intentionally omitted from the description and drawings in order not to obscure the principles of the present invention. The inventors believe that such omissions will not impede one in the art to understand and practice the present invention.

[0069] It is understood that in an alternative embodiment, the funnel can be an array of independent funnels where each funnel has its own discharge channel and the corresponding sand discharge means for discharging the sand in a similar way.

[0070] Referring back to the **FIG 7**, the two or more sand mortar making modules **72** mix sand and water to make a sand mortar for long distance transportation. In one embodiment, each of the two or more sand mortar making modules **72** has a sand groove located at the bottom of the sand mortar making module **72** for receiving the sand discharged from the funnel **73**, a sand mortar pump **721** disposed onto the bottom of the sand mortar making module **72** for mixing the sand and water from the sand groove.

[0071] The funnel with two or more discharging channels **73** receives sand from an external source (discussed hereinbelow), and then each of two or more discharging channels supplying sand to one of the two or more sand mortar making modules **72** in a controlled manner to the sand grooves. Each of the two or more discharging channels is equipped with one automatic controlling valve for controlling the volume of sand to be discharged.

[0072] The two or more water supply valves **74** control the water supply to the sand groove of the sand mortar making module **72**; it can be any suitable controllable valve. Each of the two or more water supply valves **74** is coupled to a water passage **41** that takes water from an external source and delivers to the sand groove of the sand mortar making module **72**. In operation, the water supply valves **74** are disposed at a position that is lower than the water level; thus the water can enter the water supply valves **74** without external power supply. In certain embodiments, the water-supply valves **74** are a water automatic controlling valve. In other embodiment, the water-supply valves **74** may further include motorized pump to pump-in water into the sand mortar making module **72**.

[0073] The water supply pump **75** provides water supply to the funnel **73**. The water supply pump **75** is coupled at one end with a water receiving passage **751** and at the other end with a funnel water supply passage **752**. The funnel water supply passage **752**

provides water above the funnel **73** so as to dilute and lubricate the sand, which is expected to let the sand have a smooth flow from the funnel **73** into the sand mortar-making modules **72**. The water supply can be controlled by any conventional means. The water supply can further be controlled with an aid of flow sensors for measuring the sand flow from the funnel **73** into the sand mortar-making modules **72** as required.

[0074] The sand conveying pipe **76** has two or more branches **761** at the proximal end so that each branch is coupled to each sand mortar pump **721**. The sand conveying pipe **76** is also provided one or more floaters **762** for providing buoyancy to the sand conveying pipe **76**. In certain embodiments, the sand conveying pipe **6** is a macromolecular polyethylene pipe.

[0075] In certain embodiments, the water-supply pump **5** is an SH pump, and the sand mortar pump the water-supply pump is an SH pump, and the sand mortar pump **21** is a LQ submersible mortar pump and LH booster is a LQ submersible mortar pump and LH booster.

[0076] Referring now to **FIG 8**, there is provided a schematic illustration of the sand-discharging system installed in a carrier **87** in accordance with one embodiment of the present invention. The carrier **87** provides a support for installing the sand mortar making modules **72**, funnel **73**, water supply valves **74**, water supply pump **75**, and the proximal end of the sand conveying pipe **76**. The sand conveying pipeline **76** can be supported by the floaters **762**. The carrier **77** can be a bulk cargo carrier, flat barge, platform or dock. The sand mortar making modules **72**, and water supply valves **74** are disposed within the carrier **87** at a position lower than the water level.

[0077] Referring now to **FIG 9**, there is provided a schematic illustration of the sand-discharging system in an operation mode in accordance with one embodiment of the

present invention. The carrier **87** is positioned in parallel to a sand transportation ship **98**, where the sand transportation ship **98** is equipped with a crane **99** and a sand belt feeder **910**. The sand from the sand transportation ship **98** is unloaded by the sand belt feeder **910** onto the funnel **73**. The means and operation of unloading sand from the sand transportation ship **98** onto the sand belt feeder **910** are well known in the art.

[0078] So far, the above illustrations provides that the sand discharge system is built as a sand discharge system that that is located off the sand transport vessel, where the sand loaded on the vessel is discharged onto the sand discharge system via any conventional method. In another embodiment, a sand transport vessel may comprise a funnel, a sand mortar making module, a water supply pump and a mortar extracting pump similar to the above built-in. Once the vessel arrives to its designation, a mortar conveying pipeline is connected to the mortar extracting pump so that the sand can be loaded off from the vessel directly in a form of mortar (i.e. sand with water) to a remote location.

[0079] While the present invention has been described with reference to particular embodiments, it will be understood that the embodiments are illustrative and that the invention scope is not so limited. Alternative embodiments of the present invention will become apparent to those having ordinary skill in the art to which the present invention pertains. Such alternate embodiments are considered to be encompassed within the scope of the present invention. Accordingly, the scope of the present invention is defined by the appended claims and is supported by the foregoing description.

CLAIMS

What is claimed is:

1. A sand-discharging system, comprising:

a sand mortar making module for mixing sand and water to make a sand mortar for long distance transportation;

a funnel;

a sand extracting pump; and

water supply means for supplying water to the sand mortar making module, funnel and sand extracting pump;

wherein the sand mortar making module has a sand mortar making chamber disposed within a sand and water mixing means, a water receiving port for receiving water, a sand receiving port for receiving sand from the funnel, and a sand mortar discharging port for discharging the sand mortar to the sand extracting pump;

wherein the funnel receives sand to be transported and then supplies to the sand mortar making module by a releasing passage and a sand release controller that is disposed in the way of the releasing passage or between the releasing passage and the sand receiving port; wherein the releasing passage and the sand receiving port have an inclined configuration so as to allow smooth release of the sand from the funnel into the sand mortar making chamber of the sand mortar making module; and

wherein the sand extracting pump is couple at one end with the sand mortar discharging port and at the other end with a sand mortar conveying pipeline; thereby the sand extracting pump extracts the sand mortar from the sand mortar making module from

the sand mortar discharging port and transports the sand mortar by the sand mortar conveying pipeline to a designated location.

2. The sand-discharging system of claim 1, wherein the water supply means is a water supply pump; wherein the water supply pump is coupled at one end with a water receiving passage, and at other end with a bifurcated water releasing port with a first end directly coupled with the water receiving port of the sand mortar making module and a second end directly coupled with a funnel water supply passage; thereby the water supply pump supplies water to both the sand mortar making module and funnel.

3. The sand-discharging system of claim 2, wherein the water-supply pump is an SH pump, and the sand extracting pump is a LQ submersible mortar pump and LH booster.

4. The sand-discharging system of claim 1, wherein the sand mortar conveying pipeline is a macromolecular polyethylene pipe.

5. The sand-discharging system of claim 1, wherein the water supply means includes a water supply valve that is coupled at one end with a first water receiving passage and at the other end with the water receiving port of the sand mortar making module, and a water supply pump that is coupled at one end with a second water receiving passage and at the other end with a funnel water supply passage; so that the water supply valve supplies water into the sand mortar making module and sand extracting pump, and the water supply pump supplies water into the funnel.

6. The sand-discharging system of claim 5, wherein the water supply valve is disposed at a position that is lower than water level; so that the water can enter the water supply valve without external power supply.
7. The sand-discharging system of claim 1, further comprising a carrier providing support for installing the sand mortar making module, funnel, sand extracting pump, and water supply means.
8. The sand-discharging system of claim 7, wherein the carrier is a bulk cargo carrier, flat barge, platform or dock.
9. The sand-discharging system of claim 1, further comprising one or more floaters for supporting the sand conveying pipeline in water.
10. A process for transporting sand over a long distance by a sand-discharging system of claim 1, said process comprising:
 - securing a carrier installed with the sand-discharging system to the side of a sand conveying ship in parallel;
 - starting the water supply means and sand extracting pump so as to supply water into the sand mortar-making module and funnel, then into the sand extracting pump;
 - unloading sand from the sand conveying ship into the funnel;
 - releasing the sand from the funnel into the sand mortar-making module through the sand automatic controlling valve, where the sand mortar-making module mixes the sand and water to make the sand mortar; and

transporting the sand mortar to a designated location through the sand conveying pipeline by the sand extracting pump.

11. The process of claim **10**, wherein the water supply means is a water supply pump; wherein the water supply pump is coupled at one end with a water receiving passage, and at other end with a bifurcated water releasing port with a first end directly coupled with the water receiving port of the sand mortar making module and a second end directly coupled with a funnel water supply passage; thereby the water supply pump supplies water to both the sand mortar making module and funnel.

12. The process of claim **11**, wherein the water-supply pump is an SH pump, and the sand extracting pump is a LQ submersible mortar pump and LH booster.

13. The process of claim **10**, wherein the sand mortar conveying pipeline is a macromolecular polyethylene pipe.

14. The process of claim **10**, wherein the water supply means includes a water supply valve that is coupled at one end with a first water receiving passage and at the other end with the water receiving port of the sand mortar making module, and a water supply pump that is coupled at one end with a second water receiving passage and at the other end with a funnel water supply passage; so that the water supply valve supplies water into the sand mortar making module and sand extracting pump, and the water supply pump supplies water into the funnel.

15. The process of claim **14**, wherein the water supply valve is disposed at a position that is lower than water level; so that the water can enter the water supply valve without external power supply.

16. The process of claim **10**, wherein the carrier is a bulk cargo carrier, flat barge, platform or dock.

17. The process of claim **10**, wherein the sand-discharging system further comprises one or more floaters for supporting the sand conveying pipeline in water.

18. A sand-discharging system, comprising:

two or more sand mortar making modules mixing sand and water to make a sand mortar for long distance transportation, wherein each of the two or more sand mortar making modules has a sand groove located at its bottom and a sand mortar pump disposed onto its bottom for mixing the sand and water from the sand groove;

a funnel with two or more discharge channels receiving sand from an external source, wherein each of two or more discharging channels supplies sand to each sand groove of one of the two or more sand mortar making modules;

two or more water supply valves controlling the water supply to the sand groove of the sand mortar making modules, wherein each of the two or more water supply valves is coupled to a water passage that takes water from an external source and delivers to the sand groove of the sand mortar making modules; and wherein in operation, the water supply valves are disposed at a position that is lower than the water level; so that the water can enter the water supply valves without external power supply;

a water supply pump supplying water to the funnel, wherein the water supply pump is coupled at one end with a water receiving passage and at the other end with a funnel water supply passage, and wherein the funnel water supply passage provides water above the funnel so as to dilute and lubricate the sand; and

a sand conveying pipe transporting sand mortar to a designated location, wherein the sand conveying pipe has two or more branches at the proximal end so that each branch is coupled to each sand mortar pump.

19. The sand-discharging system of claim 1, wherein each of the two or more discharging channels is equipped with one automatic controlling valve for controlling the volume of sand to be discharged.

20. The sand-discharging system of claim 1, wherein the water-supply valves are a water automatic controlling valve.