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(54) **Title:** SYSTEM AND METHOD FOR LOADING AND UNLOADING FISH

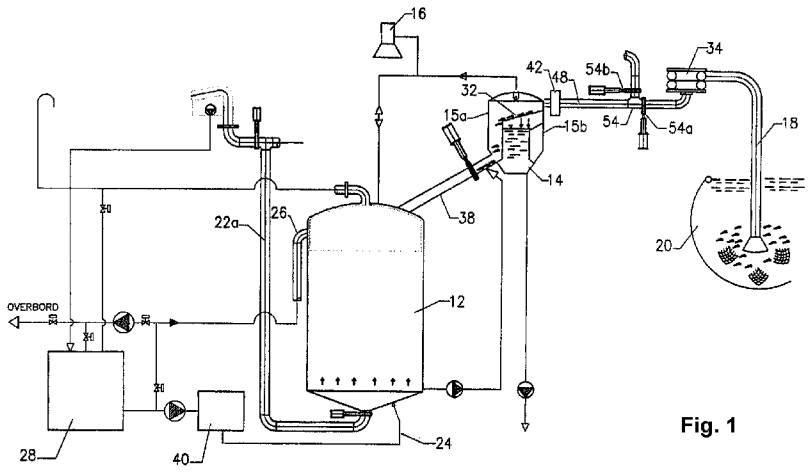

Fig. 1

(57) **Abstract:** A system and a method are described for loading of fish from a seine (20) or a trawl and on board a fishing vessel, and also unloading of fish from the fishing vessel, comprising a transportation system for fish from the seine or the trawl to, at least, one fish tank (12), means for draining of seawater and a transportation pipe system (22) for outflow of fish from said fish tank (12). A suction hose (18; 50) runs from the vessel and down into the seine (20) or the trawl, at least one vacuum and draining chamber (14) is connected to the suction hose (18), where the vacuum and draining chamber is arranged to provide an under-pressure in the suction hose for sucking in fish and water from the seine or the trawl to said vacuum and draining chamber (14), and to draining of seawater in said chamber (14.). The, at least, one fish tank (12) is connected via a pipe system (38) to said vacuum chamber (14) and is arranged to receive fish from the vacuum chamber, and the fish tank (12) comprises a lower outlet (30) for outflow of fish via an export pipe system, in that the fish tank (12) is pressurised by the pumping in of water and/or air.

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SYSTEM AND METHOD FOR LOADING AND UNLOADING FISH

The present invention relates to a system for loading of fish from a seine or a trawl and on board a fishing vessel, and also unloading of fish from the fishing vessel comprising a transportation system for fish from the seine or the trawl to, at least, one fish tank, means for draining off seawater, a transportation pipe system for removing fish from said fish tank and a suction hose that runs from the vessel and down into the seine or the trawl.

Today's solutions for unloading of fish from a seine normally involve pumping the fish on board using a hydraulic vane pump which is placed inside the seine. Fish and water are lifted high above the highest deck and the force of gravity leads the fish over draining grids for seawater, which is led overboard, and the fish are taken to the fish tanks via ducts. When the tanks are full of seawater and fish, there is a draining system in each fish tank so that one can suck from the top of the tank and pump this through a cooling installation. The cooling installation lowers the temperature of the water and the colder water is forced into the bottom of the fish tanks. Cooling installations are normally called RSW installations (refrigerated seawater).

Today's fishing vessels of a certain size typically have from 8 to 12 loading tanks for fish. A typical fish tank is normally between 150 and 250 m^3. The tanks are often long and do not have a uniform shape. Often, the tanks have an unfavourable shape because there are walkways and spaces on the main deck of the fishing vessel that take up some of the "volume" of the fish tanks. Pipes will normally run through the fish tanks. However, there is a general feeling among fishermen that the smallest tanks lead to the best fish quality.

Furthermore, fishermen are of the opinion that the known pump which pumps the fish on board can not be used for pumping the fish out of the fish tanks. This pump requires a lot of water to avoid damaging the fish, and it has been shown that when the fish die and sink to the bottom of the seine during the pumping on board, the pump starts to damage the fish. There is, therefore, a need for an improved system to pump fish on board and unload the fish.

From prior art, US 3,871,332, US 4,826,362 and JP 61127517, among others, shall be mentioned. The first two documents describe systems for loading of fish, while the last document describes a cooling installation in connection with a fish tank.

The present invention relates to a system for loading fish on board with the help of under-pressure, and to unload fish with the help of an overpressure so that there is no mechanical pumping of the fish, i.e. fish and water are sucked in from the seine or the trawl and forced out from the fish tanks.

The tank system according to the invention comprises tanks that can withstand vacuum and pressure, for example, round tanks, but is, of course, not limited to this. The fish tanks are homogenous and will not damage the fish during, for example, rolling and pitching. Furthermore, there is no need to have access to the tanks from the top and the tanks can be placed inside a superstructure if required as the fish tanks can be erected detached, with access from the bottom if required. The tanks can have a conical top and/or bottom, and also a suction funnel in the centre of the bottom. This optimises the unloading of the fish.

The RSW installation that is part of the system according to the present invention can have separate tanks as water reservoirs. Water can be sucked from these separate tanks and into the bottom of each of the fish tanks.

Furthermore, water can flow via a weir in each tank and back to the reservoir tanks. The RSW installation that is a part of the system leads to very good cooling of the fish also during unloading.

It is an object of the present invention to provide a system for a more efficient and gentle loading and unloading of fish from a trawl or a seine, and also a system that can be used for loading of fish from a trawl independent of the location of the trawl, i.e. loading from the trawl can be carried out even when the trawl is operating, during hauling in of trawl doors and weights, or when the trawl is pulled up to the fishing vessel.

The above mentioned objects are reached with a system as described in the independent claim 1, in that, at least, one vacuum and draining chamber is connected to the suction hose, where the vacuum and draining chamber is arranged to provide an under-pressure in the suction hose for sucking in fish and water from the trawl or the seine to said vacuum and draining chamber, and to drain seawater in said chamber. The, at least, one fish tank is connected to said vacuum chamber via a pipe system and is coupled together to a closed system, in which the vacuum is supplied with the help of a vacuum pump. Furthermore, the fish tank is arranged to receive fish from the vacuum chamber, and arranged to be pressurised by the pumping in of water and/or air for bringing the fish out through a lower outlet and via the transportation pipe system.

Alternative embodiments are characterised by the dependent claims 2-12.

Said fish tank preferably comprises a lower inlet for pumping in cooling water from, at least, one cooling installation and an upper overflow outlet for excess water to, at least, one buffer tank for the cooling installation and/or overboard.

Furthermore, the vacuum chamber is arranged to function as a draining chamber for seawater which is returned to the sea, and to receive water for circulation of fish to a desired fish tank. The vacuum chamber preferably comprises two chambers, one chamber for receiving seawater and one chamber for receiving fish, and an intermediate draining grid to drain seawater to said chamber to receive seawater. The vacuum chamber is preferably connected to a vacuum pump for the generation of an initial vacuum at the start up of the loading operation from the trawl or the seine.

The suction hose is preferably coiled up on a hose drum and is arranged to stretch down into the seine, and where the hose drum can comprise a swivel arrangement to guide fish and water to the, at least, one vacuum chamber.

Said fish tank can be formed in, for example, a mainly circular-cylindrical shape with conical top and bottom, but arranged to withstand pressure and vacuum irrespective of form.

The vacuum chamber can be connected to a number of fish tanks via a loading line, and a number of remote controlled valves are provided to control which of the fish tanks that shall be loaded.

The cooling installation can comprise a number of tanks for supply of water to the fish tanks and a number of buffer tanks to receive water from the outlet weir of the fish tanks.

Furthermore, each fish tank can comprise a level gauge and the cooling installation can be arranged to hold the water level approximately constant, preferably full, in each fish tank.

An alternative suction hose can run from the vessel and down into a trawl, independent of the placing of the trawl in relation to the vessel under normal trawling operations. The suction hose can run from the vessel and down into, for example, a bottom trawl, a floating trawl or a Danish seine.

Said objects are reached with a method as described in the characteristic in the independent claim 13, in that the, at least, one fish tank, a vacuum and draining chamber and a suction hose that runs down into a seine or a trawl, are coupled together to a closed system, to create a vacuum in the vacuum and draining chamber, and also the fish tank and the suction hose, so that a flow of fish and water arises in the suction hose and into the draining chamber with the help of a vacuum pump, to register said flow in a catch measuring device and to send a signal to a pump that sucks up drained seawater from a buffer tank to suck up a given amount of water during the loading, to send a signal to a pump that sucks water out from the fish tank to suck out water corresponding to the registered fish volume, and to control said pumps during loading of fish so that the water levels in the respective tanks are kept approximately constant.

Alternative embodiments of the method are characterised in the dependent claims 14-16.

Before a vacuum is created in the vacuum and drain chamber, and also the fish tank and the suction hose, the water level is preferably read in the fish tank and the buffer tank for drained seawater.

When drained water starts to run down into the buffer tank, the pump can, in the main, suck out the water that comes in to keep the level in the tank constant, and when the fish start to flow into the fish tank, the pump can pump out water to keep the level approximately constant.

When the two pumps work during loading, the vacuum pump can be stopped.

The invention will now be described with the help of the enclosed figures, in which:

Fig. 1 shows a principle diagram of a system according to the present invention.
Fig. 2 shows a further principle diagram of a system according to the present invention.

As shown in figure 1, the system comprises, at least, one fish tank 12 which is connected to a vacuum chamber 14. A pipeline 38 runs between the vacuum chamber 14 and each fish tank 12. The fish tanks can be built into the hull structure, alternatively all tanks can be completed at the shipyard with all external connections and also all internal grids in place. The tanks must be dimensioned for vacuum, for example, 0.8 bar (0.2 bar ABS) and pressure, for example, about 2 bar (3 bar ABS).

For the possibility of reversing the circulation and to apply pressure in the top of the fish tanks, vertical grid channels can be arranged from the top and down to the bottom grid. The vertical grid channels are arranged with non-return valves. Aeration in each fish tank can be connected to the overflow weir. It shall be possible to open/close the aeration individually for each tank, but a common aeration pipe can be arranged for all the tanks. Tanks should be arranged with hatches for access to the tanks for inspection/cleaning etc.

The vacuum chamber is arranged to provide an under-pressure in a suction hose 18 which is connected to the vacuum chamber via a pipeline 48. Fish and water are thus sucked via said suction hose from a seine 20 and into the vacuum chamber 14. Furthermore, the vacuum chamber 14 is

arranged for draining of seawater that is sucked up with the fish and is, in this respect, fitted with a draining grid 32 so that the vacuum chamber is divided into two sub-chambers 15a and 15b. Water from the draining chamber 15b can be led to the RSW tanks or overboard. Furthermore, a level gauge 52 can be connected to the outlet of the draining chamber 15b. Two vacuum chambers/draining chambers can, for example, be arranged on the shelter deck, which can be dimensioned for the same vacuum as the RSW tanks, where said chamber is connected to pipes from the stern/ship side and with selector switches for loading to the desired chamber. The vacuum chamber must be dimensioned so that the great demands for capacity can be met. It must be able to pump on board, for example, between 500 and 1000 tonnes of fish per hour.

During loading, the catch measuring device will give the amount coming on board. For registering of the amount of fish into the fish tank, the displaced amount of water which is pumped out of the tanks can be measured.

Furthermore, the pipeline 48 can comprise a branch cross 54 with associated selector valves 54a and 54b so that one can choose from where the fish and the water shall be sucked in. This means that the new loading system with suction can also be used during trawling, in that a suction hose 50 can be fastened on the trawl and be carried along during trawling. The suction hose 50 can run from the vessel and down into the trawl, independent of the placing of the trawl in relation to the vessel during normal trawling operations. The pipeline 48 can also comprise a catch measuring device 42 and possibly a transparent piece of pipe 44 for visual inspection of the fish during loading.

On the upper deck, a lying or standing drum 34 can be arranged for keeping a stiff suction hose 18, with a length of, for example, 30 m, for sucking in fish and

water from an adjoining seine 20. The drum 34 can drive the suction hose 18 out into the seine 20 to suck up fish and water, and to pull the hose onto the drum again when the seine is empty. The drum is preferably connected to a swivel such that a pipe guide is connected to the vacuum chamber.

Initially, a vacuum pump 16 is used to provide a vacuum in the vacuum chamber 14, and thus in the suction hose. When the loading operation has started, the vacuum pump can be turned off or its effect can be reduced to a desired level.

When fish and water get into the vacuum and draining chamber 14, the water is drained off and pumped back to the sea or to a buffer tank 28 of the RSW installation. The "dry" fish glide across the draining grid 32 and down into a new part 15a of the vacuum chamber 14, where one distributes fish to the relevant fish tanks. The chamber 14 ought to be formed so that the fish glide smoothly across the draining grid 32 and preferably without any noticeable drop from the outlet of the grid. The distribution chamber for fish can be arranged with sliding throttling valves and pipes for each fish tank, and also an overflow weir. The pipes are preferably constructed with a drop so that drained/dry fish are led into the fish tanks. The loading preferably occurs at the top of each fish tank 12. A valve for removal of fish samples can be fitted on each vacuum and draining chamber 14.

When loading is completed, cold water from a RSW buffer 28 can be pumped into the vacuum and draining chamber 14 to rinse/empty fish in the draining chamber of the fish tank. Finally, seawater can be pumped into the vacuum and draining chamber for flushing, via overflow weirs in the chamber. In this way, the draining and distribution system can be kept clean without personnel having to go in and hose down and remove fish manually.

The fish tank which shall be filled with fish is closed, in the main, full of water to a desired level and there is a vacuum in the tank. As the tank 14 is being filled with fish, water will be pumped out over the top via an overflow weir 26. This water is either led to the RSW holding tanks 28 or overboard.

The method for loading of fish is briefly comprised of the following steps: The fish tank 12, the draining chamber 14 and the suction hose 18, 50 are shut. The fish tank is filled with water and the level is read. The buffer tank 52 for drained seawater is, for example, half full and the level is read. The vacuum pump 16 creates a vacuum in the draining chamber 14 (and thereby the fish tank, and also the suction hose because everything is connected together). When sufficient vacuum has been created, a flow will commence from the suction hose 18, 50 and into the draining chamber 14. This flow is registered in the catch measuring device 42 and a signal is given to the pump that sucks drained seawater from the buffer tank 52 that it can get ready to suck out the given amount of water. At the same time, a signal goes to the pump that sucks water from the fish tank 12 that it must get ready to suck out an amount water corresponding to the registered fish volume.

When drained water starts to flow down into the buffer tank 52, the level will immediately rise and the pump will equally immediately try to keep the level in the tank constant (for example, it sucks only the water that comes in). When the fish start to flow down into the fish tank 12, the level will rise and the pump will immediately pump out water to hold the level constant (pumps out water corresponding to the amounts of fish that come in). When the two pumps (drained seawater and pumping out of the fish tank) work in this way, the vacuum pump 16 can be stopped. This will only start if there is an air leak, or if the suction hose comes out of the sea and sucks in air.

Unloading of fish takes place in that one "closes" the fish tank 12 which is to be unloaded and also opens the sliding throttle valve for the unloading well. Cold seawater is pumped from one of the RSW holding tanks 28 and into the fish tanks 12 so that cooling takes place continuously during unloading. The amount that is pumped in can only go out through the unloading well in the bottom via an unloading manifold up to the upper deck, for example, via the pipe system 22a (as shown in figure 1) or out via a pipeline 22 (as shown in figure 2). The unloading pipes from fish tanks are coupled to a loading pipe manifold before the catch measuring device so that the amount of unloaded fish is registered.

As the amount of fish in the fish tank 12 is reduced, air is pumped in to compensate for the lower level and maintains a suitable density of fish and water. Thus, an air cushion will lie above the level in the fish tank 12, which keeps a pressure corresponding to the height of lifting to the vacuum and draining chamber 14. The tank is completely emptied of fish in that one keeps the water level above the suction funnel and pumps in water until all the fish have gone. The shape of the tank bottom/unloading well is preferably so that tanks can be completely emptied of fish with water circulation and pressurised tanks. Safety valves for evacuation of air with overpressure on each tank can be arranged. During loading and unloading, it can be operated together with the RSW circulation pumps so that a back-up is provided for loading, cooling and unloading.

Two separate RSW installations can be used, and thereby provide a possibility to divide the boat into two or more separate loops. It is easy to choose how many tanks each installation shall serve. There are, for example, two RSW buffer tanks which shall hold seawater. The RSW tanks are kept full all the time during cooling. Water is sucked

from the holding tanks and is pumped into the bottom of the RSW tanks. Furthermore, an overflow weir system can be arranged from each RSW tank where the water which is pumped in flows back into the holding tanks.

From the one RSW installation a pressure line goes between the centre tanks and the port side. It is possible to force water into the bottom of both the port side tanks and the centre tanks. There is a corresponding arrangement for the tanks on the starboard side. In this way, both installations can cool all the centre tanks, but preferably one installation for the port side row of tanks, and one installation for the starboard row of tanks. It is still possible that one RSW installation can cool all the tanks (if the other is out of operation). The RSW pumps can either suck from the holding tanks or also from the top of each RSW tank.

The present system can also comprise a control and monitoring system so that a system can be provided for total integration of all fish handling within pumping, storage and cooling of the fish. During loading, a catch measuring device will give the amount which comes on board and this is guided to the desired tank. All pumps in connection with loading are controlled automatically with regard to chosen capacity. All valves can be operated remotely via chosen pumping routes or individual driving. Circulation pumps can be regulated with frequency transformers. The RSW installations can preferably be monitored and controlled remotely. All valves and pumping systems can be controlled remotely. Valves that can be regulated and measuring devices into each tank can be used.

The temperature and amount of fish in each tank can be logged and printed out, and also transferred via satellite to a buyer or an office onshore. Each fish tank logs its own history. This can also be complemented with

information about position of the vessel, lifting height from the sea and on board during loading, seawater temperature, and also any relevant data which the fish buyer might wish.

C L A I M S

1. A system for loading of fish from a seine (20) or a trawl and on board a fishing vessel, and also unloading of fish from the fishing vessel, comprising a transportation system for fish from the seine or the trawl to, at least, one fish tank (12), means for draining of seawater, a transportation pipe system (22, 22a) for outflow of fish from said fish tank (12) and a suction hose (18; 50) that runs from the vessel and down into the seine (20) or the trawl, c h a r a c t e r i s e d i n that at least one vacuum and draining chamber (14) is connected to the suction hose (18, 50), where the vacuum and draining chamber is arranged to provide under-pressure in the suction hose for sucking in fish and water from the seine or the trawl to said vacuum and draining chamber (14), and to draining of seawater in said chamber (14), that the, at least, one fish tank (12) is connected via a pipe system (38) to said vacuum chamber (14) and are connected together into a closed system, in which vacuum is created with the help of a vacuum pump (16), and that the fish tank (12) is arranged to receive fish from the vacuum chamber, and arranged to be pressurised by the pumping in of water and/or air for outflow of fish through a lower outlet (30) and via the transportation pipe system.

2. A system according to claim 1, c h a r a c t e r i s e d i n that said fish tank (12) comprises a lower inlet (24) for pumping in cooling water from, at least, one cooling installation and an upper overflow weir (26) for return of excess water to, at least, one buffer tank (28) to the cooling installation and/or overboard.

3. A system according to claim 2, characterised in that the vacuum chamber (14) is arranged to function as a draining chamber for seawater which is returned to the sea, and to receive water for circulation of fish to the desired fish tank.

4. A system according to claim 3, characterised in that the vacuum chamber (14) comprises two chambers, one chamber (15b) to receive seawater and one chamber (15a) to receive fish and a draining grid (32) for draining of seawater to said chamber (15b) for receiving seawater.

5. A system according to claims 3 or 4, characterised in that the vacuum chamber (14) is connected to a vacuum pump (16) for the generation of an initial vacuum at the start up of the loading operation from a trawl or a seine.

6. A system according to claim 1, characterised in that the suction hose (18) is coiled up onto a hose drum (34) and arranged to stretch down into the seine (20), where the hose drum comprises a swivel arrangement to guide the fish and water to the, at least, one vacuum chamber (14).

7. A system according to claim 1, characterised in that said fish tank (12) is formed in a mainly circular-cylindrical shape with a conical top and bottom, arranged to withstand pressure and vacuum.

8. A system according to one or more of the preceding claims, characterised in that said vacuum chamber (14) is connected to a number of fish tanks (12) via a loading line, and that a number of remotely controlled valves are provided for control of which fish tank is to be loaded.

9. A system according to one or more of the preceding claims, c h a r a c t e r i s e d i n that the cooling installation comprises a number of tanks (40) for the supply of water to the fish tanks (12) and a number of buffer tanks (28) to receive water from the overflow of the fish tanks.

10. A system according to one or more of the preceding claims, c h a r a c t e r i s e d i n that each fish tank (12) comprises a level gauge (46) and that the cooling installation is arranged to keep the water level in each fish tank, in the main, constant.

11. A system according to one or more of the preceding claims, c h a r a c t e r i s e d i n that a suction hose (50) runs from the vessel and down into a trawl, independent of the placing of the trawl in relation to the vessel during normal trawling operations.

12. A system according to claim 11, c h a r a c t e r i s e d i n that the suction hose (50) runs from the vessel and down into a bottom trawl, a floating trawl or a Danish seine.

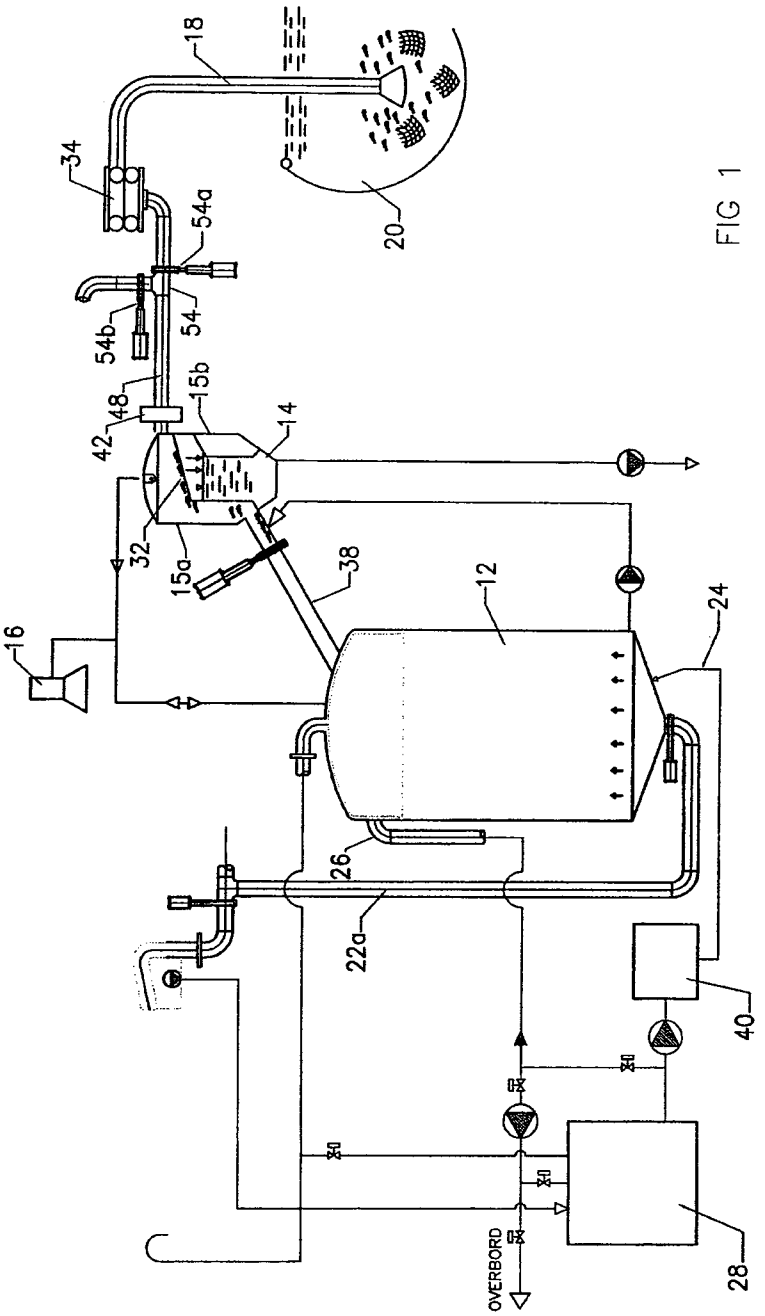
13. Method for unloading of fish from a seine (20) or a trawl and on board a fishing vessel, comprising a transportation system for fish from the seine or the trawl to at least one fish tank (12), means for draining of seawater and a transportation pipe system (22) for bringing fish from said fish tank (12), c h a r a c t e r i s e d i n
- that the, at least, one fish tank (12), a vacuum and draining chamber (14) and a suction hose (18; 50) that runs down into a seine or a trawl, are coupled together in a closed system,
- to apply a vacuum on the vacuum and draining chamber (14), and also the fish tank (12) and the suction hose

(18; 50), so that a flow of fish and water occurs in the suction hose (18; 50) and into the draining chamber (14) with the help of a vacuum pump (16),
- to register said flow in a catch measuring device (42) and to send a signal to a pump which sucks drained seawater from a buffer tank (52) to suck out a given amount of water during the loading.
- to send a signal to a pump that sucks water out of the fish tank (12) to suck out water corresponding to the registered volume of fish, and
- to control said pumps during loading of fish so that the water level in the respective tanks is held approximately constant.

14. Method according to claim 13, c h a r a c t e r i s e d i n that before a vacuum is created for the vacuum and draining chamber (14), and also the fish tank (12) and the suction hose (18; 50) , the water level is read in the fish tank (12) and the buffer tank (52) for drained seawater.

15. Method according to claim 14, c h a r a c t e r i s e d i n that when drained water starts to run down into the buffer tank (52), the pump sucks out mainly the water that comes in to keep the level in the tanks constant and when the fish start to flow into the fish tank (12), the pump pumps out water to keep the level approximately constant.

16. Method according to claim 15, c h a r a c t e r i s e d i n that when the two pumps work during loading, the vacuum pumps (16) are stopped.


18
34
54a
54
54b
15b
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42
14
32
15a
38
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24
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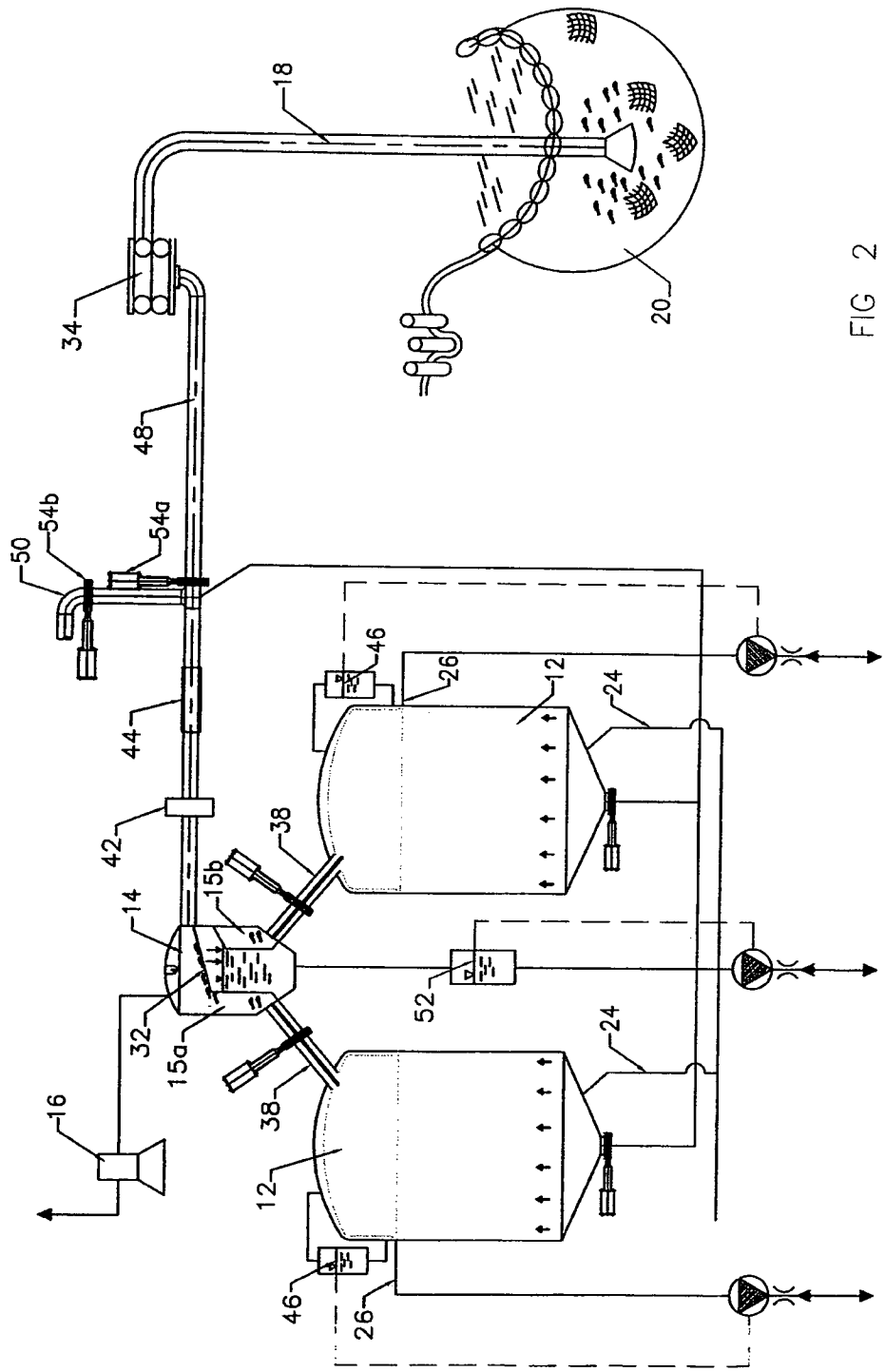
22a
40
28
OVERBORD
20

FIG 1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54b
54a
50
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38
15b
14
32
15a
16
46
26
12
24
52
Overbord/RSW-tanker

FIG 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2008/000219

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B65G, A01K, A23B, A22B, F04F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4826362 A (HAYASHI), 2 May 1989 (02.05.1989), whole document ---	1-16
A	JP 52055990 A (..), 7 May 1977 (07.05.1977), figure 1 ---	1-16
A	US 3871332 A (HAYASHI), 18 March 1975 (18.03.1975), whole document ---	1-16
A	JP 61127517 A, HAYASHI TAKESHI, 1986-06-14: (abstract) Retrieved from: PAJ database; Original document: Fig. 1-8 ---	1-16

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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International patent classification (IPC)

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A23B 4/06 (2006.01)

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