

DESCRIPTION

SYSTEM FOR SAMPLING SHIP BALLAST WATER

TECHNICAL FIELD

[0001]

The present invention relates to a system for sampling ship ballast water and more specifically to a system for sampling ship ballast water in which the ballast water is continuously sampled in order to inspect if the ballast water taken into the ship satisfies a standard or not.

BACKGROUND ART

[0002]

In cargo ships for transporting crude oil, containers and the like, a ballast tank is provided in order to maintain stability of a ship's body during navigation. Usually, while the crude oil or the like is not loaded, the ballast tank is filled with ballast water and when the crude oil, containers and the like are to be loaded, the ballast water is discharged so as to adjust a buoyancy power of the ship's body and to stabilize the ship body.

[0003]

As mentioned above, the ballast water is water required for safe navigation of ships, and usually seawater in a port where a cargo is handled is usually used. The amount is estimated at 3 to 4 billion tons a year on a global basis.

[0004]

In the ballast water, aquatic organisms (including microorganisms and bacteria) living in the port where the water is taken are mixed, and with movement of the ship, the aquatic organisms are also carried to foreign countries.

[0005]

Therefore, destruction of an ecological system in which organism species not originally inhabiting the marine area take place for the existing organism species has become serious.

[0006]

With such a situation as a background, at diplomatic conferences in International Maritime Organization (IMO), the International Convention for Control and Management of Ship's Ballast Water and Sediments was adopted and the obligation to manage ballast water is scheduled to be applied to ships constructed in 2009 and after.

[0007]

Therefore, ships are required to discharge clean ballast water satisfying the Convention.

[0008]

As a prior-art method of physically treating water containing microorganisms such as plankton, a technique to disinfect or sterilize the microorganisms in the ballast water by inputting an ozone gas into the ballast water is disclosed in Patent Document 1.

[0009]

Also, a technique to mechanically destroy and perish the aquatic organisms by

having water containing the aquatic organisms pass through a slit plate by a high-pressure pump is disclosed in Patent Document 2.

Patent Document 1: Japanese Patent Laid-Open No. 2004-160437

Patent Document 2: Japanese Patent Laid-Open No. 2003-200156

Patent Document 3: Japanese Patent Laid-Open No. 9-192680

Patent Document 4: Japanese Patent Laid-Open No. 2003-326275

DISCLOSURE OF INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0010]

If the ballast water discharged from the ship satisfies the above standard or not should be inspected by taking out a part of the ballast water as sample water. In this case, in order to determine a population of the aquatic organisms contained in the ballast water, it is necessary to sample 3 m³ of the sample water once at the maximum, which means that a large storage tank having a capacity of 3 m³ should be installed in the ship.

[0011]

However, it is extremely difficult particularly for existing ships to newly ensure a space for installing a large storage tank having a capacity of 3 m³ in the ship.

[0012]

Moreover, direct sampling of the ballast water in a ballast tank, which is large and is divided into a plurality of chambers is an extremely time-consuming work.

[0013]

Also, inspection of a population of the aquatic organisms requires an extremely laborious work performed while the sample water is observed by a microscope and the aquatic organisms living in the sample water is checked. Thus, if an amount of the sample water becomes huge such as in the inspection of the ballast water, first, the work should be started with condensation of the aquatic organisms from the large quantity of ballast water, which requires a long working time. During that period, the ship cannot discharge the ballast water and a loading work or departure cannot be made, which is a large loss for shipping companies. Therefore, to finish the inspection of the ballast water in a short time is the most important issue.

[0014]

However, in the microscopic inspection, the aquatic organisms need to be condensed while they are alive from the ballast water, and this condensation work requires an extremely long time and labor, which has made reduction in time of the ballast water inspection extremely difficult.

[0015]

Thus, the present invention has an object to provide a system for sampling ship ballast water and a method of sampling ship ballast water that do not need to install a large storage tank but can easily and continuously take in the ballast water and sample aquatic organisms contained in the ballast water while they are alive.

[0016]

Other objects of the present invention will be made clear from the following descriptions.

MEANS FOR SOLVING PROBLEM

[0017]

The above problems are solved by each of the following inventions.

[0018]

An invention described in claim 1 is a sampling system of ship ballast water for sampling ballast water in order to inspect aquatic organisms contained in the ship ballast water, provided with a sampling nozzle installed in a water-pouring line for pouring the ballast water into a ballast tank and / or a discharge line for discharging the ballast water in the ballast tank to the outside of a ship and continuously sampling a part of the ballast water from the water-pouring line and / or the discharge line and a sampling device for condensing the aquatic organisms contained in the ballast water sampled from the sampling nozzle, the sampling device having a water storage container for adjustably retaining reservoir water inside, in such a way that a fixed quantity of reservoir water is retained; a filter cloth having an upper end opening and a lower end opening, dipped in the reservoir water in the water storage container so that the upper end opening is exposed and partitioning the inside of the water storage container into two parts, that is, inside and outside spaces; a supply port for supplying ballast water sampled from the sampling nozzle into the inside of the upper end opening of the filter cloth; a discharge port for discharging the reservoir water in the water storage container from outside the filter cloth in the water storage container; a reservoir part disposed consecutively to the lower end opening of the filter cloth in the water storage container and temporarily retaining water containing aquatic organisms remaining inside the filter cloth, when the reservoir water in the water storage container is discharged through the discharge port; and a housing container for housing water containing the aquatic organisms which are retained in the reservoir part.

[0019]

An invention described in claim 2 is a sampling system of ship ballast water described in claim 1, in which a drain tank for temporarily reserving the reservoir water discharged from the water storage container and a drain pump for continuously discharging the reservoir water in the drain tank to the water-pouring line and the discharge line.

[0020]

An invention described in claim 3 is a sampling system of ship ballast water described in claim 1 or 2, in which the supply port is opened at a distal end of a nozzle rotatably disposed along an inner circumference of the filter cloth when the ballast water is supplied into the inside of the filter cloth and / or the reservoir water in the water storage container is discharged.

[0021]

An invention described in claim 4 is a sampling system of ship ballast water described in claim 1, 2 or 3, in which the sampling device has water-flow generating means for generating a water flow going inward from the outside of the filter cloth outside the filter cloth in the water storage container and exfoliating the aquatic organisms adhering to the inside of the filter cloth.

[0022]

An invention described in claim 5 is a sampling system of ship ballast water

described in any one of claims 1 to 4, in which a sampling valve for opening / closing a flow passage of the ballast water supplied to the sampling device, a flow meter for measuring a supply amount of the ballast water supplied to the sampling device, and first control means for controlling opening / closing of the sampling valve on the basis of a measurement result of the flow meter are further provided.

[0023]

An invention described in claim 6 is a sampling system of ship ballast water described in claim 5, in which a discharge valve for opening / closing the discharge port is further provided, and the first control means closes and controls the sampling valve on the basis of the measurement result of the flow meter and then, opens and controls the discharge valve and executes control to discharge the reservoir water in the water storage container through the discharge port.

[0024]

An invention described in claim 7 is a sampling system of ship ballast water described in any one of claims 1 to 6, in which the ballast tank is provided in plural, and opening / closing valve for opening / closing the water-pouring line and / or the discharge line of each of the ballast tanks, respectively, visualizing means for visualizing information, and second control means for opening / closing controlling the opening / closing valve so that the ballast water is poured or discharged for each tank with respect to the plurality of ballast tanks, obtaining the information of the ballast tank during water-pouring or discharging, associating the ballast tank performing the water-pouring or discharging with the ballast water sampled by the sampling nozzle on a one-to-one basis when the ballast water is sampled by the sampling nozzle outputting the result to the visualizing means are further provided.

[0025]

An invention described in claim 8 is a sampling system of ship ballast water described in claim 7, in which the visualizing means is a monitor for displaying the information on a screen and / or a printer for printing the information.

EFFECT OF THE INVENTION

[0026]

According to the present invention, a system for sampling ship ballast water and a method of sampling ship ballast water in which a large storage tank does not need to be provided, the ballast water can be sampled easily and continuously, and the aquatic organisms contained in the ballast water can be sampled while they are alive can be provided.

BRIEF DESCRIPTION OF DRAWINGS

[0027]

Fig. 1 is a configuration diagram illustrating an outline of an essential part of a ship in which a sampling system of ship ballast water according to the present invention is provided on a plan view;

Fig. 2 is a configuration diagram illustrating a detail of the sampling system of ship ballast water according to the present invention;

Fig. 3 is an enlarged diagram of A part in Fig. 2;

Fig. 4 is an outline diagram illustrating an example of a sampling device;

Fig. 5 is a diagram for explaining a mesh size of a filter cloth;

Fig. 6 is a diagram for explaining an operation of the sampling device;

Fig. 7 is a diagram for explaining an operation of the sampling device;

Fig. 8 is a diagram for explaining an operation of the sampling device;

Fig. 9 is a diagram for explaining an operation of the sampling device; and

Fig. 10 is an outline diagram illustrating another mode of means for adjusting a water storage amount in a water storage tank to a fixed quantity.

EXPLANATIONS OF LETTERS OR NUMERALS

[0028]

1	ship body
2, 2A to 2D	ballast tank
3	sea chest
4	ballast pump
5	intake pipe
6	strainer
7	pipe
8, 8'	discharge port
9	main pipe
10	water pouring / discharge nozzle
11	bypass pipe
12a to 12g	opening / closing valve
13	treatment device
13a, 13b, 13c	opening / closing valve
14	sampling system
141	sampling nozzle
142	water sampling pipe
143	sampling device
144	flow meter
145	opening / closing valve
146	return pipe
147	drain tank
148	drain pump
15	removing device
100	control part
201	display device
202	printer
202a	label sheet
300	water storage container
301	lid body
303	filter cloth
303A	warp
303B	weft
303a	upper end opening
303b	lower end opening

304	reservoir part
305	water sampling pipe
306	opening / closing valve
307	housing container
308	nozzle
308a	supply port
309	liquid level sensor
310	switching valve
311	branch pipe
311a	supply port
312	overflow pipe
312a	upper end opening
313	discharge port
314	opening / closing valve
315	water-flow generator
316A, 316B	water level detector
317	water amount control part

BEST MODE(S) FOR CARRYING OUT THE INVENTION

[0029]

Embodiments of the present invention will be described below using the attached drawings.

[0030]

Fig. 1 is a configuration diagram illustrating an outline of a ballast water piping in which a treatment device of ship ballast water in existing ballast water piping and a sampling system of ship ballast water according to the present invention are disposed on a plan view. Here, a container ship loading containers is exemplified as a ship. In the figure, reference numeral 1 denotes a ship body, and reference numeral 2 denotes a plurality of ballast tanks disposed in the vicinity of a bow of the ship body 1.

[0031]

To each ballast tank 2, ballast water is taken in from a sea chest 3 provided in the vicinity of the ship's bottom by an operation of a ballast pump 4. In the present invention, as the ballast water to be treated, seawater, fresh water and the like are used, and such ballast water contains aquatic organisms such as zooplankton, phytoplankton and the like, microorganisms, bacteria and the like (hereinafter simply referred to as aquatic organisms). The ballast pump 4 is disposed at an intake pipe 5 for taking the ballast water into the ship body 1 through the sea chest 3, and a strainer 6 is interposed at a portion 5' on a primary side (inlet side of the ballast pump 4) of the intake pipe 5.

[0032]

This strainer 6 eliminates relatively large impurities in the ballast water flowing into the ballast pump 4. Those having a hole of 5 to 10 mm ϕ or preferably 8 mm ϕ with a pitch of 5 to 15 mm or preferably 11 mm can be used for example.

[0033]

Reference numeral 7 is a pipe disposed crossing the ship body 1, and the both ends

are connected to discharge ports 8 and 8' disposed at both sides of the ship body 1. A portion 5'' of a secondary side (outlet side) of the ballast pump 4 of the intake pipe 5 is connected to a middle part of the pipe 7.

[0034]

Reference numeral 9 provided between the pipe 7 and each ballast tank 2 is a main pipe for pouring the ballast water into each ballast tank 2 and discharging the ballast water from each ballast tank 2, and its one end is connected to a middle part of the pipe 7. To the other end, a pouring / discharge nozzle 10 disposed in each ballast tank 2 is connected, respectively, for pouring and discharging water of each ballast tank 2.

[0035]

Reference numeral 11 is a bypass pipe used for discharging the ballast water in each ballast tank 2 to the outside of ship body 1 by an operation of the ballast pump 4, and is disposed at the portion 5' on the secondary side (outlet side) of the strainer 6 in the intake pipe 5 so as to connect the primary side (inlet side) of the ballast pump 4 and the main pipe 9 to each other.

[0036]

Components with reference numerals 12a to 12g are opening / closing valves.

[0037]

If the ballast water is to be poured into each ballast tank 2 by the ballast water piping, the opening / closing valves 12a, 12b, 12e, and 12g are opened, while the opening / closing valves 12c, 12d, and 12f are closed, respectively, and then, the ballast pump 4 is operated and the ballast water is taken in from the sea chest 3 through the intake pipe 5. The ballast water flowing from the sea chest 3 to the intake pipe 5 has large rubbish removed by the strainer 6 and then, transferred to the main pipe 9 through the pipe 7 disposed to cross the ship body 1. The ballast water transferred to the main pipe 9 is poured into each ballast tank 2 from the pouring / discharge nozzle 10 disposed in each ballast tank 2.

[0038]

Therefore, in this case, the intake pipe 5, the pipe 7, and the main pipe 9 constitute a water pouring line for pouring the ballast water into the ballast tank 2 in the ballast water piping.

[0039]

Also, if the ballast water in each ballast tank 2 is to be discharged, the opening / closing valves 12b, 12c, 12d, and 12g are opened, while the opening / closing valves 12a and 12e are closed and then, the ballast pump 4 is operated and the ballast water in each ballast tank 2 flows into the pipe 7 from the pouring / discharge nozzle 10 through the main pipe 9, the bypass pipe 11, the intake pipe 5, and the ballast pump 4 and discharged from the discharge ports 8 and 8' on both sides of the ship body 1 to the outside.

[0040]

Therefore, in this case, the main pipe 9, the bypass pipe 11, the intake pipe 5, and the pipe 7 constitute a discharge line for discharging the ballast water in the ballast tank 2 to the outside of the ship in the ballast water piping.

[0041]

In such existing ballast water piping, a treating device 13 for ballast water is disposed.

[0042]

The treating device 13 is disposed so as to branch from a middle part at a pipe portion 7' between a connection portion to the intake pipe 5 and a connection portion to the main pipe 9 in the pipe 7 in the above-described existing ballast water piping and take in the ballast water, remove aquatic organisms and bacteria in the ballast water, sterilize or perish them and returns it again to the pipe portion 7'.

[0043]

In such treating device 13, a filter for removing relatively large aquatic organisms in the ballast water, a device for sterilizing or perishing the aquatic organisms and bacteria by strong oxidation action of ozone by pouring ozone generated by an ozone generator at a predetermined concentration into the ballast water, a device for destroying the aquatic organisms by a shearing force generated when the ballast water is made to pass a slit plate having a slit-shaped opening, a device for removing or decomposing unsolved ozone after the ozone pouring and the like may be disposed.

[0044]

Reference numerals 13a, 13b, and 13c in the figure denote opening / closing valves for taking in and discharging the ballast water between the pipe 7 and the treating device 13.

[0045]

The treatment of the ballast water by the treating device 13 is performed when the ballast water is taken into the ship. Therefore, in treating the ballast water, the opening / closing valves 12a, 12b, 12e, 12g, 13b, and 13c are opened, while the opening / closing valves 12c, 12d, 12f, and 13a are closed, respectively, and then, the ballast pump 4 is operated and the ballast water is taken in from the sea chest 3 through the intake pipe 5. The ballast water flowing from the sea chest 3 into the intake pipe 5 has large rubbish removed by the strainer 6 and then, flows into the treating device 13 through the pipe 7, where the removal, sterilization or perishing of the aquatic organisms and bacteria in the ballast water is performed.

[0046]

In this embodiment, a sampling system 14 for ship ballast water according to the present invention is disposed to inspect if the ballast water after being treated by the treating device 13 satisfies the IMO standards or not. This sampling system 14 is disposed capable of taking in the ballast water to be discharged to the outside of the ship body 1 from a pipe portion 7'' between a portion where the main pipe 9 is connected and a discharge port 8' in the pipe 7. The details of the sampling system 14 will be described hereinafter.

[0047]

If the ballast water is to be discharged to the outside of the ship body 1, in order to remove oxidant containing harmful bromine oxides in the ballast water, as shown in Fig. 1, a removing device 15 for removing the oxidant by activated coal is preferably provided. By means of the removing device 15, oxidizing substances (bromine oxides, for example) such as harmful oxidants and the like contained in the treated ballast water can be removed.

[0048]

In Fig. 1, the removing device 15 is disposed between a connection portion to the main pipe 9 and the sampling system 14 in the pipe portion 7'' in the pipe 7. In the removing device 15, an activated coal tank, for example, is provided so that the ballast water discharged through the pipe 7 is taken in and made to pass through the activated coal tank and then, returned to the pipe 7 again.

[0049]

The removing device 15 is disposed in front of the sampling system 14 but it may be disposed between the sampling system 14 and the discharge port 8'.

[0050]

Fig.2 is a configuration diagram illustrating an outline of the sampling system 14. Here, only four ballast tanks 2A, 2B, 2C, and 2D are shown. The other same reference numerals as in Fig. 1 denote the same configurations.

[0051]

By means of the sampling system 14 as above, a part of the ballast water flowing through the pipe portion 7'' in the pipe 7 is sampled.

[0052]

Fig. 3 is an enlarged diagram of an A part in Fig. 2, and as shown in the figure, a sampling nozzle 141 is disposed opposing the water flow direction of the ballast water in the pipe portion 7'' so that a part of the ballast water in the pipe portion 7'' (hereinafter also referred to as sample water in some cases) is sampled at an equal flow velocity and sent to a sampling device 143 through a sampling pipe 142. The equal flow velocity sampling means sampling so that the flow velocity of the ballast water flowing through the pipe portion 7'' is equal to the flow velocity of the sample water sampled by the sampling nozzle 141. For sampling of the sample water, pressure by driving of the ballast pump 4 is used.

[0053]

The sampling nozzle 141 is to continuously sample a part of the ballast water flowing through the pipe portion 7'' in the pipe 7, and a pipe diameter of the sampling nozzle 141 can be 25 mm, for example, if the internal diameter of the pipe 7 is 300mm.

[0054]

In the sampling pipe 142, a flow meter 144 for measuring a flow rate (accumulated flow rate) of the sample water and a sampling valve 145 for opening / closing a flow passage of the sampling pipe 142 are disposed. A measurement result of the flow meter 144 is sent to a control part 100.

[0055]

The control part 100 checks if a predetermined amount of the ballast water or 3 m³ of the ballast water, for example, has been sent to the sampling device 143 or not from the measurement result of the flow meter 144 and controls opening / closing of the sampling valve 145 (first control means).

[0056]

Also, the control part 100 further controls opening / closing (second control means) of the opening / closing valve 12g individually so that water pouring / discharging of each of the ballast tanks 2A to 2D is performed for each tank and controls an opening degree of an opening / closing valve 14a disposed in the pipe 7.

[0057]

Subsequently, a detail of the sampling device 143 is shown in Fig. 4.

[0058]

In Fig. 4, reference numeral 300 denotes a water storage container, and reference numeral 301 denotes a lid body provided at an upper part of the water storage container 300. The water storage container 300 is formed in a cylindrical shape, for example, and a filter

cloth 303 for sampling the aquatic organisms to be sampled is installed inside.

[0059]

The filter cloth 303 has an upper end opening 303a and a lower end opening 303b and is formed preferably in a shape of substantially inverted cone narrowed from the upper end opening 303a toward the lower end opening 303b, and by detachably mounting peripheral edge of the upper end opening 303a on an upper inner peripheral face of the water storage container 300, the filter cloth is installed in a suspended state inside the water storage container 300. As a result, the inside of the water storage container 300 is divided into a space 300A outside the filter cloth 303 and a space 300B inside the filter cloth 303.

[0060]

A product sold in the market can be used as the filter cloth 303. A cloth woven in a net state by crossing a warp and weft made of resin such as nylon, in which an intersection between the warp and weft is welded by heating and fixed in order to prevent stitch displacement, is preferable, for example. A mesh size of the filter cloth 303 is determined according to the size of the aquatic organism to be sampled such that the mesh size is 50 μ m if an aquatic organism is to be sampled with a size exceeding 50 μ m, for example. This mesh size is determined by a distance A of a diagonal line of a lattice formed between the warp 303A and the weft 303B of the filter cloth 303 as shown in Fig. 5.

[0061]

A reservoir part 304 is consecutively provided at the lower end opening 303b of the filter cloth 303. The reservoir part 304 is a container for temporarily reserve water (condensed water) containing the aquatic organisms remaining inside the filter cloth 303 in the end in the water storage container 300 and collecting the condensed aquatic organisms and is formed by a synthetic resin or the like in a funnel shape sufficiently smaller than the water storage container 300, for example. To a bottom portion of the reservoir part 304, a water sampling pipe 305 opened / closed by an opening / closing valve 306 is connected, and by opening the opening / closing valve 306, the water containing the aquatic organisms (condensed water) reserved in the reservoir part 304 can be contained in a housing container 307 outside the water storage container 300. The housing container 307 is detachably disposed in the water sampling pipe 305.

[0062]

The other end of the water sampling pipe 142 with the sampling nozzle 141 provided at one end is disposed from the upper part on the side portion of the water storage container 300 into the water storage container 300 and toward the inside of the upper end opening 303a of the filter cloth 303. A nozzle 308 disposed at the other end of this water sampling pipe 142 is arranged inside the filter cloth 303 lower than the upper end opening 303a of the filter cloth 303 and is bent so that a supply port 308a opened at an end portion thereof is directed to the inner peripheral face of the filter cloth 303. The nozzle 308 is preferably disposed capable of rotation in 360 degrees in the horizontal direction by driving means, not shown, and the supply port 308a is rotatable along the inner periphery of the filter cloth 303.

[0063]

A liquid level sensor 309, which is liquid level detecting means, is disposed lower than the upper end opening 303a of the filter cloth 303 and upper than the nozzle 308 for detecting a water level inside the filter cloth 303. A detection signal of the liquid level

sensor 309 is outputted to the control part 100 shown in Fig. 2.

[0064]

In the middle of the water sampling pipe 142, a switching valve 310 is interposed outside the water storage container 300, and a branch pipe 311 is branched from the switching valve 310. The branch pipe 311 is disposed from the upper part on the side portion of the water storage container 300 into the inside, and its distal end 311a is located outside the filter cloth 303 so as to supply the sample water fed from the water sampling pipe 142 into the water storage container 300 outside the filter cloth 303.

[0065]

In the water storage container 300, an overflow pipe 312 is disposed similarly outside the filter cloth 303, penetrates a bottom part 300a of the water storage container 300 and is connected to a discharge pipe 146. The overflow pipe 312 has excess water overflow if the inside of the water storage container 300 has a water amount larger than a certain level and discharges it to the outside of the water storage container 300 so that the inside of the water storage container 300 is adjusted to have a predetermined water amount all the time and determines the water level of the reservoir water in the water storage container 300 by a position of an upper end opening 312a. The upper end opening 312a is disposed to be located lower than the upper end opening 303a of the filter cloth 303, lower than the liquid level sensor 309, and upper than the lower end opening 303b of the filter cloth 303.

[0066]

In the bottom part 300a of the space 300A in the water storage container 300, a discharge port 313 is formed, and by opening a discharge valve 314, the reservoir water inside is discharged to the discharge pipe 146. The discharge valve 314 is opened / closed and controlled by the control part 100 shown in Fig. 2.

[0067]

Outside the filter cloth 303 in the water storage container 300, a water-flow generator 315 is disposed. The water-flow generator 315 assists smooth reservation and collection of the aquatic organisms inside the reservoir part 304 by injecting water toward the outer peripheral face of the filter cloth 303 so as to generate a water flow from the outside toward the inside of the filter cloth 303 and exfoliating the aquatic organisms adhering to the inside of the filter cloth 303 in a state in which water is reserved in the water storage container 300 and is preferably disposed in the present invention.

[0068]

The water injection from the water-flow generator 315 can be performed using the reservoir water outside the filter cloth 303 reserved in the water storage container 300 by driving means such as a pump, not shown.

[0069]

The water-flow generator 315 is preferably disposed in a ring shape along the outer periphery of the filter cloth 303 but an appropriate number of the water-flow generators may be arranged in division along the outer periphery of the filter cloth 303 with a predetermined interval.

[0070]

Also, the water-flow generator 315 may be disposed vertically movably inside the water storage container 300.

[0071]

Subsequently, an action of the sampling device 143 as above will be described using Figs. 6 to 9.

[0072]

First, as shown in Fig. 6, by means of an operation of the switching valve 310, water is supplied from the water sampling pipe 142 to the space 300A outside the filter cloth 303 in the water storage container 300 by the branch pipe 311 so as to reserve reservoir water W1 in the water storage container 300. As the reservoir water W1, ballast water is preferably used from the viewpoint of maintaining an inhabiting environment of the aquatic organisms in the water storage container 300.

[0073]

The reservoir water W1 supplied to the outside of the filter cloth 303 in the water storage container 300 enters the space 300B inside the filter cloth 303 through the filter cloth 303. The reservoir water W1 is reserved in the water storage container 300 in a constant water amount such that if the reservoir water exceeds the upper end opening 312a of the overflow pipe 312, it is discharged from the overflow pipe 312.

[0074]

At this time, the upper end opening 303a of the filter cloth 303 is located upper than the reservoir water level and is exposed from the reservoir water W1. Also, even if the aquatic organisms are contained in the reservoir water W1 in the space 300A outside the filter cloth 303, the aquatic organisms with the size exceeding the mesh size of the filter cloth 303, that is, with the size to be sampled by the filter cloth 303, do not enter the inside of the filter cloth 303.

[0075]

If a predetermined amount of the reservoir water W1 is reserved in the water storage container 300, as shown in Fig. 7, by means of the operation of the switching valve 310, sample water W2 sent from the sampling nozzle 141 by the water sampling pipe 142 is supplied to the space 300B inside the filter cloth 303 from the nozzle 308. At this time, the supply is preferably performed while the nozzle 308 is rotated in the horizontal direction. The rotation of the nozzle 308 can be made once / second, for example.

[0076]

By means of the supply of the sample water W2 to the inside of the filter cloth 303 from the nozzle 308, a water storage amount in the water storage container 300 is increased, but an increase overflows from the overflow pipe 312 and is discharged to the outside of the water storage container 300, and the inside of the water storage container 300 is kept at a constant water amount. Thus, regardless of the capacity of the water storage container 300, a desired large quantity of the sample water W2 can be continuously supplied.

[0077]

By continuously supplying the sample water W2 into the inside of the filter cloth 303 from the nozzle 308, the increase overflows from the overflow pipe 312, by which the excess water is moved from the inside of the filter cloth 303 to the outside, and an amount of the aquatic organisms with the size to be sampled that cannot pass the filter cloth 303 is increased in the filter cloth 303.

[0078]

At this time, since the reservoir water W1 has been reserved first in the water storage container 300, the aquatic organisms contained in the sample water W2 supplied to the inside of the filter cloth 303 is prevented from suddenly being filtered and pressed into contact with the filter cloth 303, but damage on an individual organism in the aquatic organisms by the filter cloth 303 can be prevented, and the aquatic organisms do not terminate.

[0079]

Also, by supplying the sample water W2 while the nozzle 308 is rotated, a swirl flow can be created inside the filter cloth 303. Thus, even if the aquatic organisms adhere to the inner peripheral face of the filter cloth 303, the sample water W2 can be supplied while the aquatic organisms are exfoliated by the swirl flow, clogging of the filter cloth 303 can be prevented, and the aquatic organisms can be condensed efficiently.

[0080]

If the water level inside the filter cloth 303 should be raised due to some factor such as clogging of the filter cloth 303, the overflow pipe 312 or the like, it is detected by the liquid level sensor 309. By using this detection as a trigger, the control part 100 shown in Fig. 2 can automatically stop the supply of the sample water W2. As a result, overflow of the sample water W2 supplied to the inside of the filter cloth 303 from the upper end opening 303a of the filter cloth 303 is prevented.

[0081]

A flow rate of the sample water W2 supplied from the nozzle 308 to the inside of the filter cloth 303 is measured by the flow meter 144 disposed in the water sampling pipe 142 shown in Fig. 2, and opening / closing of the sampling valve 145 is controlled by the control part 100 on the basis of the measurement result. Thus, if the aquatic organisms contained in a water amount of 3m^3 are to be measured, for example, by measuring the amount of 3m^3 by the flow meter 144, a desired water amount can be supplied easily without requiring a tank or the like with a large capacity for reserving the sample water W2. Moreover, since the water storage container 300 is adjusted to have a constant water amount all the time by the overflow pipe 312, by continuously supplying a desired water amount, the aquatic organisms per desired unit water amount can be accurately sampled regardless of the capacity of the water storage container 300.

[0082]

Subsequently, if a desired water amount of the sample water W2 has been supplied to the inside of the filter cloth 303 from the nozzle 308, the supply of the sample water W2 is stopped by closing the sampling valve 145 through control of the control part 100 and then, as shown in Fig. 8, the discharge valve 314 is opened by the control part 100 so as to discharge the reservoir water W1 in the space 300A in the water storage container 300 through the discharge port 313.

[0083]

At the discharge, not only the reservoir water W1 outside the filter cloth 303 but also the sample water W2 inside the filter cloth 303 is moved from the inside to the outside of the filter cloth 303 and discharged from the discharge port 312. Therefore, the aquatic organisms that cannot pass the filter cloth 303 remain inside the filter cloth 303.

[0084]

At this time, by supplying washing water or the like in which the aquatic organisms

are not contained from the rotating nozzle 308 toward the inner peripheral face of the filter cloth 303, the aquatic organisms adhering to the inside of the filter cloth 303 is preferably washed off.

[0085]

Moreover, in addition to or instead of the water spraying from the nozzle 308, a water flow is preferably generated from the water-flow generator 315 toward the outer peripheral face of the filter cloth 303 so that the aquatic organisms adhering to the inside of the filter cloth 303 is peeled off during the discharge.

[0086]

Also, though not shown, it is also preferable that micro vibrating means for applying micro vibration to the filter cloth 303 is disposed capable of being controlled by the control part 100 so that exfoliation of the aquatic organisms by micro vibration of the filter cloth 303 during the discharge is promoted. The micro vibration of the filter cloth 303 by the micro vibrating means may be performed at the supply of the sample water W2 to the inside of the filter cloth 303.

[0087]

After the reservoir water W1 in the water storage container 300 has been discharged from the discharge port 313, or when the discharge progresses till the water level of the reservoir water W1 becomes lower than the reservoir part 304, as shown in Fig. 9, only condensed water W3 containing the aquatic organisms remaining inside the filter cloth 303 is reserved in the reservoir part 304. Since in this condensed water W3, the aquatic organisms are condensed substantially without applying a pressure with which the organisms are filtered by the filter cloth 303, the aquatic organisms are condensed while they are alive without being damaged.

[0088]

The condensed water W3 in the reservoir part 304 is contained in the housing container 307 from the water sampling pipe 305 by opening the opening / closing valve 306 by the control part 100. The containing of the condensed water W3 in the housing container 307 can be performed by receiving a detection signal by the control part 100 from water level detecting means (water level detection sensor), not shown, disposed in the water storage container 300. Other than the above, it may be so configured that an amount of water discharged from the discharge valve 314 is measured or an elapsed time since opening of the discharge valve 314 is used as a trigger.

[0089]

The aquatic organisms contained in the condensed water W3 are sampled and condensed alive without damages on individual organisms. Moreover, since the condensation work only requires supply of the desired amount of the ballast water (sample water), the work can be done easily and in a short time.

[0090]

Also, since the water storage container 300 is adjusted so that a water reserved amount is made constant, it can be formed in a compact manner regardless of the water amount of the supplied sample water W2 and has an advantage of space saving.

[0091]

As means for adjusting the reservoir water amount in the water storage container 300

to a constant amount, instead of the overflow pipe 312, a discharge port for overflow, not shown, may be disposed in a side wall of the water storage container 300 so as to directly overflow from the discharge port to the outside.

[0092]

Also, as shown in Fig. 10, it may be so configured that two water level detection sensors 316A and 316B are arranged at upper and lower predetermined positions in the water storage container 300 and controlled so that if the upper water level detection sensor 316A detects a water level, the discharge valve 314 is opened by a water amount control part 317 so as to discharge the reservoir water, while if the lower water level detection sensor 316B no longer detects the water level, the discharge valve 314 is closed by the water amount control part 317 and the reservoir water in the water storage container 300 is adjusted to become a constant water amount. The function of the water amount control part 317 may be provided in the control part 100 shown in Fig. 2.

[0093]

Instead of the configuration in which the reservoir part 304 is consecutively provided at the lower end opening 303b of the filter cloth 303, the water sampling pipe 305 may be directly provided consecutively at the lower end opening 303b of the filter cloth 303. In this case, the inside of the water sampling pipe 305 between the lower end opening 303b of the filter cloth 303 and the opening / closing valve 306 functions as a reservoir part for reserving the condensed water W3.

[0094]

Moreover, a configuration for supplying the reservoir water W1 to the outside of the filter cloth 303 in the water storage container 300 may be a configuration for supplying the ballast water or other types of water through a pipe in a system different from the water sampling pipe 142 instead of the branch pipe 311 branching from the water sampling pipe 142.

[0095]

As shown in Fig. 2, a drain tank 147 is connected to the discharge pipe 146 for discharging water (including overflow water) discharged from the sampling device 143, and the discharged water is temporarily reserved in this drain tank 147. In the drain tank 147, a water level detector, not shown, is disposed, and if the inside reaches a predetermined water level, it is returned to the pipe portion 7'' in the pipe 7 continuously by a drain pump 148 driven and controlled by the control part 100.

[0096]

The drain tank 147 is a so-called buffer tank for temporarily reserving the water discharged from the sampling device 143 to be fed out by the drain pump 148 to the pipe portion 7'', and it does not have to have a large capacity but can be constituted by a tank with a small capacity. In the drain tank 147, an air-bleeding port 147a is disposed.

[0097]

Subsequently, an example of the control for a sampling operation by the sampling system 14 will be described.

[0098]

If the ballast water reserved in each of the ballast tanks 2A to 2D is to be discharged, the control part 100 appropriately controls an opening degree of the opening / closing valve 14a and first, opens and controls only the opening / closing valve 12g of the ballast tank 2A,

for example, so as to start discharge of the ballast water from the ballast tank 2A. The ballast water in this discharge is the ballast water having been already treated by the treating device 13, sampled by the sampling nozzle 141 in a course through the pipe portion 7'' of the pipe 7 toward the discharge port 8' and flows into the water sampling pipe 142. For this sampling of the sample water, a pressure generated by driving of the ballast pump 4 is used.
[0099]

If a predetermined amount of the sample water is continuously sampled from the sampling nozzle 141, the aquatic organisms are condensed and collected by the sampling device 143 as mentioned above and contained in the housing container 307.
[0100]

Here, the sampling system 14 has a monitor 201 and a printer 202, which are visualizing means, in the vicinity of the sampling device 143, and they are electrically connected to the control part 100, respectively. The monitor 201 is constituted by a liquid crystal monitor, for example, and visualizes information of the ballast tank 2A currently discharging the ballast water by displaying it on a screen from the control part 100. Also, the printer 202 performs visualization by printing the information of the ballast tank 2A discharging the ballast water sent from the control part 100 and printing and outputting it on a label sheet 202a or the like.
[0101]

The sampling amount of the sample water is monitored by the control part 100 through the flow meter 144. During this period, the continuously sampled sample water continuously overflows from the water storage container 300 of the sampling device 143 and is reserved in the drain tank 147 and then, continuously returned to the pipe portion 7'' of the pipe 7.
[0102]

If the predetermined amount of the sample water has been sampled by the sampling device 143 from the sampling nozzle 141, the sampling valve 145 is closed and operated, while the opening degree of the opening / closing valve 14a is returned and the sampling of the ballast water into the sampling device 143 is finished.
[0103]

If a predetermined amount of the sample water has been sampled from the ballast water discharged from the ballast tank 2A, a worker can associate the ballast tank 2A with the sample water on a one-on-one basis by checking the monitor 201 or by attaching the label sheet 202a on which the information for specifying the ballast tank 2A outputted from the printer 202 is printed to the housing container 307 removed from the sampling device 143.
[0104]

For the one-on-one association between the ballast tank 2A and the sample water, only either one of the monitor 201 or the printer 202 may be used or a printer capable of directly printing the information on the housing container 307 may be used other than the above.
[0105]

After that, in the other ballast tanks 2B to 2D, too, the sample water is sequentially sampled from the discharged ballast water similarly to the above.
[0106]

As the result of inspection of the sample water in the housing container 307, if the ballast water does not satisfy the IMO standards, it is preferable that an ozone pouring part, not shown, is provided in advance at the pipe portion 7'' in front of the discharge port 8' so that ozone is poured into the ballast water so as to remove, sterilize or terminate the existing aquatic organisms and then, to discharge the water to the outside of the ship body 1 or that the ballast water to be discharged is sent to the treating device 13 again to be re-treated by the treating device 13.

[0107]

As described above, according to the sampling system of the ship ballast water according to the present invention, the sample water is continuously sampled from the ballast water flowing through the pipe 7 by the sampling nozzle 141, and there is no labor needed to directly sample from each of the ballast tanks 2 but the ballast water can be sampled easily.

[0108]

In this embodiment, the sample water is sampled by the sampling system 14 in discharge of the ballast water, but the sampling system 14 may sample the sample water in pouring of the ballast water. Therefore, in this case, the sampling system 14 is disposed in the pipe portion 7' of the pipe 7 between the treating device 13 and a connection portion to the main pipe 9, for example, so that the sample water can be sampled from the ballast water after the water is treated by the treating device 13 and before being poured into each of the ballast tanks 2.

[0109]

Also, for more safety, the sample water may be sampled both in pouring and discharging of the ballast water. In this case, the water sampling pipe may be disposed so that the sample water can be sampled both from the pouring line and the discharge line of the ballast water by the single sampling system 14 or the sampling system 14 is disposed respectively in both the pouring line and the discharge line of the ballast water so that separate sampling systems 14 are operated in pouring and discharge of the ballast water.

CLAIMS

1. A system for sampling ship ballast water for sampling said ballast water in order to inspect aquatic organisms contained in the ship ballast water, comprising:
 - a sampling nozzle disposed in a water-pouring line for pouring the ballast water into a ballast tank and / or a discharge line for discharging the ballast water in the ballast tank to the outside of a ship and continuously sampling a part of the ballast water from said water-pouring line and / or said discharge line; and a sampling device for condensing the aquatic organisms contained in the ballast water sampled from said sampling nozzle, wherein
 - said sampling device has a water storage container for adjustably reserving reservoir water inside, in such a way that a predetermined amount of reservoir water is reserved;
 - a filter cloth having an upper end opening and a lower end opening, dipped in the reservoir water in said water storage container so that said upper end opening is exposed and partitioning the inside of said water storage container into two parts, that is, inside and outside spaces;
 - a supply port for supplying ballast water sampled from said sampling nozzle into the inside of said upper end opening of said filter cloth;
 - a discharge port for discharging the reservoir water in said water storage container from outside said filter cloth in said water storage container;
 - a reservoir part disposed consecutively to the lower end opening of said filter cloth in said water storage container and temporarily reserving water containing aquatic organisms remaining inside said filter cloth, when the reservoir water in said water storage container is discharged through said discharge port; and
 - a housing container for housing water containing the aquatic organisms which are reserved in said reservoir part.
2. The system for sampling ship ballast water according to claim 1, further comprising:
 - a drain tank for temporarily reserving the reservoir water discharged from said water storage container; and
 - a drain pump for continuously discharging the reservoir water in said drain tank to said water-pouring line and said discharge line.
3. The system for sampling ship ballast water according to claim 1 or 2, wherein
 - said supply port is opened at a distal end of a nozzle rotatably disposed along an inner circumference of said filter cloth when the ballast water is supplied into the inside of said filter cloth and / or the reservoir water in said water storage container is discharged.
4. The system for sampling ship ballast water according to claim 1, 2 or 3, wherein
 - the sampling device has water-flow generating means for generating a water flow going inward from the outside of the filter cloth outside the filter cloth in the water storage container and exfoliating the aquatic organisms adhering to the inside of the filter cloth.
5. The system for sampling ship ballast water according to any one of claims 1 to 4, further comprising:
 - a sampling valve for opening / closing a flow passage of the ballast water supplied to

said sampling device;

a flow meter for measuring a supply amount of the ballast water supplied to said sampling device; and

first control means for controlling opening / closing of said sampling valve on the basis of a measurement result of said flow meter.

6. The system for sampling ship ballast water according to claim 5, further comprising a discharge valve for opening / closing said discharge port, wherein

said first control means closes and controls said sampling valve on the basis of the measurement result of said flow meter and then, opens and controls said discharge valve and executes control to discharge the reservoir water in said water storage container through said discharge port.

7. The system for sampling ship ballast water according to any one of claims 1 to 6, wherein

said ballast tank is provided in plural, and further comprising:

opening / closing valve for opening / closing said water-pouring line and / or said discharge line of each of said ballast tanks, respectively;

visualizing means for visualizing information; and

second control means for opening / closing controlling said opening / closing valve so that the ballast water is poured or discharged for each tank with respect to said plurality of ballast tanks, obtaining the information of the ballast tank during water-pouring or discharging, associating the ballast tank performing said water-pouring or discharging with the ballast water sampled by said sampling nozzle on a one-on-one basis when the ballast water is sampled by said sampling nozzle and outputting the result to said visualizing means.

8. The system for sampling ship ballast water according to claim 7, wherein said visualizing means is a monitor for displaying the information on a screen and / or a printer for printing the information.