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(54) METHOD AND MEANS FOR PREVENTING MARINE GROWTH ON SHIPS

(71) I, OYSTEIN RASMUSSEN, a Norwegian Subject, of Hoslevei 119, 1340 Bekkestua, Norway, do hereby declare the invention, for which I pray that a Patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method for preventing marine growth on a ship, and particularly a ship having substantially vertical side surfaces, by utilising the electrolytic decomposition products of sea water. The invention also relates to a means for carrying out the method.

It is known to use the decomposition products of sea water as anti-fouling substances for marine micro-organisms on the underwater surface of ships, an electrode system mounted on the side of the ship being used for this purpose. It is also known to carry out the decomposition in a container on board the ship.

Further known are systems utilising the decomposition of sea water with an intensifying effect caused by simultaneous dissolving of other anti-fouling substances. The decomposition of the sea water and the addition of other anti-fouling substances is carried out in perforated pipes on the side of the ship, the sea water being introduced on one side and the decomposition products being distributed from the other side. Such systems, in the form of pipes, are preferably mounted at the fore end of the ship, but have also been mounted in the longitudinal direction thereof.

Systems are also known, where liquid chemical anti-fouling substances are distributed over an underwater surface and where gas, for example air, is supplied in order to achieve an improved distribution.

A disadvantage of the known systems is the uncontrolled supply of anti-fouling substances with no consideration to the prevailing conditions. The effect of the anti-fouling

substance is therefore random and dependent on currents, the possible movement of the ship, the water conditions and other environmental factors.

An aim of the present invention is to provide an improved method for preventing marine growth on ships, and in particular to achieve an effective distribution of anti-fouling substances over the substantially vertical surfaces of the ship, as the said anti-fouling substances tend to float away from the said surfaces. The method is based on the same principles as described hereinabove, but the system is more expediently constructed, so as to achieve an improved control of the supply of anti-fouling substances, improved distribution and concentration of anti-fouling substances to the side of the ship, and therefore a fuller and more effective protection.

According to the invention, a method for preventing marine growth on a ship by utilisation of the electrolytic decomposition products of sea-water is characterised in that sea water is conveyed to a chamber within the ship where it is subjected to electrolysis, the electrolysis being carried out to below the saturation point of chlorine in sea water in order to avoid the evolution of gaseous chlorine, in that the decomposition products in solution i.e. anti-fouling substances, are conveyed in controlled amounts to the side of the ship where a distribution system is arranged, and in that the anti-fouling substances and air are discharged into the sea through perforations in the distribution system, the air being discharged beyond the anti-fouling substances in an amount such that a dense blanket of air is formed, whereby the anti-fouling substances, due to the density of the air blanket and the turbulence caused by the air, are retained adjacent the side of the ship and float slowly to the surface of the sea.

A dense blanket of air is formed when the ratio of the distance between the air discharge openings and the distance from the

surface of the water does not exceed 0.02, preferably equal to or less than 0.014.

By employing the method according to the invention, a substantial improvement is achieved in comparison with the prior art, since the electrolysis is undertaken at a location where it may be controlled, and in that it is possible to supply the anti-fouling substances and air to the side of the ship as required and in a distribution adapted to the prevailing conditions. It is also an advantage that the anti-fouling substances are produced on board the ship as required, so that a store of anti-fouling substances, possibly in the form of gas, for example chlorine under pressure, is then unnecessary.

All that has to be kept on board is a small, harmless supply of the dissolved anti-fouling substances for immediate requirements.

In accordance with a preferred feature of the invention, the concentration of anti-fouling substance is measured at the side of the ship, for example by means of a redox-electrode and this measurement is used for controlling the amount of anti-fouling substances supplied from the electrolysis chamber. In this manner, an automatic adjustment of the system is achieved so that there is a sufficient amount of anti-fouling substance present at all times and marine growth is prevented.

Furthermore, sea water which has been employed as cooling water on the ship may be used for the electrolysis. This has the advantage of giving wide possibilities for regulating the temperature of the electrolysis and thus of activating the decomposition process as desired.

The anti-fouling substances and the air may be discharged into the sea in the area at or through the bilge keel, if this is suitably positioned; the anti-fouling substances may also be discharged at the bottom region of the ship.

A means for carrying out the method according to the invention, comprises an electrolysis chamber, within the ship, provided with an inlet for sea water and an outlet pipe to a distribution system, an air compressor connected through a pipe to the distribution system, and a distribution system including discharge openings for anti-fouling substances arranged in horizontal juxtaposed position, and air openings located at a great distance from a side of the ship. A plurality of perforated areas may also be arranged for the discharge of air, positioned in horizontal spaced relationship and between the ship side and the above said air openings. The distribution system may comprise a perforated pipe system.

In the means according to the invention, a pipe system may be used which may be disposed either within the ship or externally of the side of the ship, discharge openings for the substances to the outer surface of the

ship being provided in the first case. Since air is discharged both vertically and horizontally along areas of the side of the ship, a kind of pocket effect is formed, whereby the anti-fouling substances rise from the bottom in a pocket the sides of which consist of the side of the ship and air on the other three sides. The side of the ship is thus divided into areas, which permits improved distribution and control of the supply of anti-fouling substances and also ensures a uniform distribution of flow, by means of the vertical air sluices. It is possible that the air and the anti-fouling substances may be forced sideways, but due to the transversely positioned walls of the pockets such away-flow is restricted and a uniform distribution is maintained over the entire side. The said transverse wall effect may, if desired, be increased by extending the vertical perforated areas along the side of the ship.

The invention will now be further described by way of example, with reference to the accompanying drawing, in which

Figure 1 is a schematic sectional view of a ship illustrating the method according to the invention,

Figure 2 is a sectional plan, on an enlarged scale, of part of the side of the ship of Figure 1, and

Figure 3 is a side view, on a reduced scale, of the ship of Figure 1.

In the drawing, the anti-fouling substance released into the sea is indicated by broken lines, and air is indicated by small circles.

In the ship shown in Figure 1, sea water is conveyed at 10 directly from the sea, or after use as cooling water on the ship, to an electrolysis chamber 1 where the water is decomposed to provide anti-fouling substances for marine organisms by means of an electrode system 11, 12 which is adapted to receive voltage from a suitable voltage source 13. Since the electrolysis is undertaken in a closed container within the ship, this process can be under continuous control. From the chamber 1 the decomposition products are conveyed through pipes 2 to openings 14 at the side of the ship 3 (Figure 2), for example in the area at or through the bilge keel, if this is suitably positioned, where they are released into the sea. Air, for example from the ship's compressor 4, is conveyed to the same area of the side of the ship through pipes 5, and the air is released substantially through openings 15 outside the anti-fouling substances. A blanket of air is thus formed on the outside of the anti-fouling substances. The air blanket must obviously be sufficiently dense effectively to prevent the anti-fouling substances from penetrating the blanket. The density requirements of the air blanket are fulfilled if the ratio of the distance a between the air discharge openings (Figure 2) and their distance l from the surface of the water

(Figure 1) does not exceed 0.02 preferably equal to or less than 0.014. A reference electrode 6, such as a redox-electrode for recording the concentration of the anti-fouling substance, may be mounted at a suitable location on the side of the ship, and this measurement is used to control via 16 the amount of anti-fouling substances supplied through the pipe 2 from the electrolysis chamber, and, optionally, for controlling via 17 the actual electrolysis process.

Figure 2 shows the discharge openings for anti-fouling substances and air. The openings are provided by a perforated pipe system at the side 3 of the ship, the pipe for air discharge being indicated by 8, and the pipe for anti-fouling substances by 18. Branch pipes 7 are arranged perpendicularly between the side of the ship and the air pipe 8, these branch pipes 7 being provided with perforations through which air is also discharged into the sea. In this manner, a type of pocket for the anti-fouling substances is formed between the side 3 of the ship, the rising air from the pipes 7 and the outer, rising air layer from the pipe 8. The anti-fouling substances rise through these pockets from openings 14 in the pipe 18. By reason of the turbulence effect from the air, which rises more rapidly through the water than the anti-fouling substances, the anti-fouling substances remain within the pocket, pressed against the ship's side, and their rise is obstructed, so that they remain at the ship's side for a longer period of time, thus giving an improved effect. It is emphasised, however, that the invention is not restricted to such division by pockets.

Figure 3 shows how the pipes 8 and 18 are disposed substantially horizontally in the area of the bilge keel 9.

In order to protect the bottom area of the ship, it is expedient in certain cases to arrange in addition openings for the anti-fouling substances in the bottom area of the ship, for example at 20 in Figure 1, to which the said substances are conveyed through a pipe 19.

WHAT I CLAIM IS:—

1. A method for preventing marine growth on a ship by utilisation of the electrolytic decomposition products of sea-water, characterised in that sea water is conveyed to a chamber within the ship where it is subjected to electrolysis, the electrolysis being carried out to below the saturation point of chlorine in sea water in order to avoid the evolution of gaseous chlorine, in that the decomposition products in solution, i.e. anti-fouling substances, are conveyed in controlled amounts to the side of the ship where a dis-

tribution system is arranged, and in that the anti-fouling substances and air are discharged into the sea through perforations in the distribution system, the air being discharged beyond the anti-fouling substances in an amount such that a dense blanket of air is formed, whereby the anti-fouling substances, due to the density of the air blanket and the turbulence caused by the air, are retained adjacent the side of the ship and float slowly to the surface of the sea.

2. A method according to claim 1, in which the concentration of anti-fouling substances at the side of the ship is measured, and that the measurement is used for controlling of the amount of anti-fouling substances supplied from the electrolysis chamber.

3. A method according to claim 2, in which the concentration is measured by means of a redox-electrode.

4. A method according to any preceding claim, in which sea water which has been used as cooling water on the ship is used for the electrolysis.

5. A method according to any preceding claim, in which the anti-fouling substances and the air are discharged into the sea in the region of, or through, the bilge keel.

6. A method according to claim 5, in which anti-fouling substances are also discharged at the bottom area of the ship.

7. Means for carrying out the method claimed in any of the preceding claims, comprising an electrolysis chamber, within the ship, provided with an inlet for sea water and an outlet pipe to a distribution system, an air compressor connected through a pipe to the distribution system, and a distribution system including discharge openings for anti-fouling substances arranged in horizontal juxtaposed position, and air openings located at a greater distance from a side of the ship.

8. Means according to claim 7, comprising a plurality of perforated areas for air discharge, located in spaced relationship between the side of the ship and the air openings.

9. Means according to claims 7 or 8, in which a pipe system having perforations is used as distribution system.

10. A ship provided with the means claimed in any of claims 7 to 9.

11. A ship constructed and arranged substantially as herein described with reference to the accompanying drawing.

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(Figure 1) does not exceed 0.02 preferably equal to or less than 0.014. A reference electrode 6, such as a redox-electrode for recording the concentration of the anti-fouling substance, may be mounted at a suitable location on the side of the ship, and this measurement is used to control via 16 the amount of anti-fouling substances supplied through the pipe 2 from the electrolysis chamber, and, optionally, for controlling via 17 the actual electrolysis process.

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7. Means for carrying out the method claimed in any of the preceding claims, comprising an electrolysis chamber, within the ship, provided with an inlet for sea water and an outlet pipe to a distribution system, an air compressor connected through a pipe to the distribution system, and a distribution system including discharge openings for anti-fouling substances arranged in horizontal juxtaposed position, and air openings located at a greater distance from a side of the ship.

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