Furthermore, the invention strives to provide improved control and safety of the air lubrication system.

It is another object of the invention to provide an air lubrication system having improved airflow characteristics.

Summary of the invention

According to an aspect of the present application, there is provided a vessel comprising a hull having a center line, opposing sides and a substantially flat bottom, the vessel having a number of air lubricating systems, each system comprising sidewalls and a top wall defining a cavity with an opening situated in an interface plane that is transversely to the sidewalls, substantially at the level of the flat bottom, the opening having a front end and a rear end when seen in the length direction of the cavity and forming an air-water interface plane in which air is mixed into the water due to the Kelvin Helmholtz mixing effect, an air inlet spaced from the opening of the cavity, the cavity having a length (Lc) and substantially extending in a longitudinal direction of the hull, a distance of the top wall from the interface plane (Hc) and a width (W), wherein the ratio Lc/Hc is in the range of 7:1 to 13:1, characterized in that the vessel comprises a sharp bow and an accordingly shaped flat bottom, the ratio W/H is in the range of 1.3:1 to 2.5:1 and the ratio Lc/W is in the range of 3.5 to 1 to 7:1, wherein on each side of the center line of the vessel at least three cavities are distributed across the bottom in the length direction along a straight or curved line extending from the center line near the bow, to a respective side to form a V-shaped cavity distribution such that the cavities are following the hull shape, a rear part of the foremost cavities being situated closer to the bow, when seen along the center line, than a front part of the third cavities.

Hereto a system according to the invention is characterised in that on each side of the center line of the vessel at least three cavities are distributed across the bottom in the length direction along a line extending from the center line near the bow, to a respective side.

With this "V-shaped" cavity distribution, an even blanket of air bubbles can be spread across the entire width of the bottom. The line along which the cavities are situated may be straight or curved, or may be comprised of segments of different curvature. The inventors have found that utilizing a larger number of small sized cavities results in a favorable air bubble distribution generated at relatively low energy input.

According to a further embodiment, the cavities may be arranged in such a manner that the rear end of a cavity closest to the bow, is positioned further from the bow than the front end the adjacent cavity seen in the direction towards the stern.

For a vessel with a sharp bow and an accordingly shaped flat bottom, the cavities are following the hull shape for an optimal distribution of air lubrication across the width of the bottom. The fanning-out distribution of cavities results in improved strength of the bottom compared to the case in which the cavities are aligned in the length direction of the vessel.

For effective distribution of air bubbles across the hull, in the region near the bow, the two front most cavities may be situated at a predetermined distance from the center line, two additional cavities closer to the stern being situated at a smaller distance from

Claims

1. Vessel (1) comprising a hull (4) having a center line (50), opposing sides (51,52) and a substantially flat bottom (6), the vessel having a number of air lubricating systems (7,8), each system comprising sidewalls (18,18') and a top wall (19) defining a cavity (33) with an opening (20) situated in an interface plane (30) that is transversely to the sidewalls, substantially at the level of the flat bottom, the opening having a front end (22) and a rear end (21) when seen in the length direction of the cavity and forming an air-water interface plane in which air is mixed into the water due to the Kelvin Helmholtz mixing effect, an air inlet (23) spaced from the opening of the cavity, the cavity having a length (Lc) and substantially extending in a longitudinal direction of the hull (4), a distance of the top wall (19) from the interface plane (30) (Hc) and a width (W), wherein the ratio Lc/Hc is in the range of 7:1 to 13:1, characterized in that the vessel comprises a sharp bow (2) and an accordingly shaped flat bottom, the ratio W/H is in the range of 1.3:1 to 2.5:1 and the ratio Lc/W is in the range of 3.5 to 1 to 7:1, wherein on each side of the center line (50) of the vessel (1) at least three cavities (54,54'-59,59') are distributed across the bottom in the length direction along a straight or curved line extending from the center line (50) near the bow (2), to a respective side (51,52) to form a V-shaped cavity distribution such that the cavities are following the hull shape, a rear part of the foremost cavities (54,54') being situated closer to the bow (2), when seen along the center line (50), than a front part of the third cavities (56,56').

2. Vessel (1) according to claim 1, wherein the length (Lc) of the cavity is between 2 m and 10 m, the distance of the top wall (19) from the interface plane (30) being between 0.2 m and 1.5 m, a width (W) being between 0.4 m and 2 m.

3. Vessel (1) according to claim 1 or 2, wherein the rear end (71) of a cavity (54') closer to the bow (2) is positioned further from the bow than the front end of the adjacent cavity (55') seen in the direction towards the stern (3).

4. Vessel (1) according to claim 1, 2 or 3, wherein in the region near the bow (2), the two front most cavities (54,54') are situated at a predetermined distance from the center line (5), two additional cavities (53,53') further towards the stern (3) being situated at a smaller distance from the center line (50).

5. Vessel (1) according to any of claims 1-4, comprising for each cavity (7,8) a corresponding compressor (11,12) for injecting air into the cavity at a pressure substantially corresponding to the hydrostatic pressure in each cavity.

6. Vessel according to any of claims 1-4, accommodating for each pair of cavities on opposite sides of the center line at a predetermined length position, a corresponding compressor (11,12) for injecting air into the cavity pair at a pressure substantially corresponding to the hydrostatic pressure in each cavity.