Claims

1. A submergible cleaning system for cleaning an underwater hull surface of a vessel while the vessel is afloat or an offshore facility, the cleaning system comprising:

- a housing comprising a top face and side faces having edges and an open bottom face, the edges and bottom face being arranged opposite the hull surface , and the housing further comprising:

- a rotary disc having a plurality of nozzles arranged around a periphery of the rotary disc, the nozzles facing the hull surface,

- rolling spacing devices for providing a predetermined first gap between the rotary disc and the hull surface,

- a suction device fluidly connected to an outlet arranged in the housing for providing a negative pressure within the housing,

- a pressurising device fluidly connected with the nozzles for providing a high pressure fluid to the nozzles, whereby the nozzles are adapted for discharging fluid under high pressure against the hull surface for cleaning,

wherein the housing further comprises a shroud at least partly arranged between the rotary disc and the housing, whereby a chamber is provided between the housing and the shroud, the chamber being in fluid communication with the suction device.

2. A submergible cleaning system according to claim 1, wherein the shroud comprises a top shroud face and side shroud faces having shroud edges and an open bottom shroud face, the shroud edges and bottom shroud face being arranged opposite the hull surface.

3. A submergible cleaning system according to claim 2, wherein the shroud is arranged within the housing with a predetermined second gap between the side shroud faces and the side faces of the housing.

4. A submergible cleaning system according to claim 3, wherein the predetermined second gap is smaller than 0.03 m, preferably smaller than 0.025 m, more preferably smaller than 0.015 m.

5. A submergible cleaning system according to any of the preceding claims, wherein the edges of the housing comprises a skirt, the skirt being made of a flexible material.

6. A submergible cleaning system according to any of the preceding claims, wherein a plurality of rotary discs are arranged within the housing.

7. A submergible cleaning system according to claim 6, wherein two adjacent rotary discs have opposite directions of rotation for decreasing a friction between them.

8. A submergible cleaning system according to claim 6 or 7, wherein the shroud is arranged between the plurality of discs and the housing.

9. A submergible cleaning system according to claim 6, wherein a shroud is arranged around each rotary disc, and a chamber is arranged around the shroud, the chamber being in fluid communication with the suction device.

10. A submergible cleaning system according to any of the preceding claims, wherein the rotary disc(s) is/are driven by one or more motor(s).

11. A submergible cleaning system according to any of the preceding claims, wherein each rotary disc comprises a rotational axis, and the nozzles are supplied with the high pressure fluid through a hollow spindle arranged concentrically to the rotational axis.

12. A submergible cleaning system according to claim 11, wherein the pressure of the fluid leaving the nozzles may be between 30 and 150 bar, preferably between 50 and 125 bar.

13. A submergible cleaning system according to any of the preceding claims, wherein the rolling spacing devices are adjustable for adjusting the first gap between the rotary disc and the hull surface.

14. A submergible cleaning system according to claim 13, wherein the size of the first gap is adjusted automatically during the cleaning by adjusting the rolling spacing devices by means of a pressure controller.

15. A submergible cleaning system according to any of the preceding claims, wherein a rotation of the rotary disc is adjustable.

16. A submergible cleaning system according to claim 15, wherein the rotation of the rotary disc is in the range of 250 to 550 rpm, preferably in the range of 350 to 450 rpm.

17. A submergible cleaning system according to claim 15 or 16, wherein the pressure provided to the nozzles is adjusted in relation to the rotation speed of the rotary discs so that when the rotation of the discs speed decreases, the pressure provided to the nozzles is decreased accordingly and vice versa.

18. A submergible cleaning system according to any of the preceding claims, wherein the nozzles are cavitation type nozzles adapted to induce cavitation in front of the nozzle to provide high and localised stresses on the hull surface due to bubble cavity collapse.

19. A submergible cleaning system according to any of the preceding claims, wherein the rotary disc comprises a disc surface arranged opposite the hull surface, the nozzles being arranged below the disc surface.

20. A submergible cleaning system according to claim 19, wherein the nozzles are arranged in level with the disc surface.

21. A submergible cleaning system according to any of the preceding claims, wherein the nozzles may be adapted to be adjusted so that an angle of attack of the high pressure fluid can be altered in view of a rotation direction of the rotary disc.

22. A submergible cleaning system according to any of the preceding claims, wherein the nozzles are interlocked with a pressure switch in the housing, so that the cleaning is provided only when the housing has a negative pressure.

23. A submergible cleaning system according to any of the preceding claims, wherein a residue and debris recovery arrangement is arranged in relation to the

outlet in the housing for collecting effluent water from the cleaning of the hull surface.

24. A submergible cleaning system according to claim 23, wherein the recovery arrangement comprises a filter unit adapted to filter the effluent water for residues and/or debris.

25. A submergible cleaning system according to claim 23, wherein the filter unit is completely submerged so that the suction pump does not have to lift the effluent water above the sea level.

26. A submergible cleaning system according to claim 25, wherein the filtered effluent water is discharged into the seawater when filtered.

27. A submergible cleaning system according to claim 24, wherein the filter unit comprises a long filter sock.

28. A submergible cleaning system according to any of the preceding claims, further comprising a remotely operated vehicle (ROV).

29. A submergible cleaning system according to claim 28, wherein the ROV comprises propulsion means.

30. A submergible cleaning system according to claim 28 or 29, wherein the rotation speed of the rotary discs are adjusted in relation to a speed of the ROV so that when the speed of the ROV increases, the rotation speed of the discs will increase accordingly and vice versa.

31. A submergible cleaning system according to any of the claims 28-30, wherein thrusters, cameras, sonar equipment, compasses and/or light devices is/are arranged in connection with the ROV.

32. A submergible cleaning system according to claim 31, wherein the thrusters are electrically powered.

33. A submergible cleaning system according to any of the claims 28-32, wherein the ROV is equipped with a navigation and orientation device, said navigation and orientation device being connected to the control unit.

34. A vessel or workboat comprising the submergible cleaning system according to any of the preceding claims.

35. A vessel or workboat according to claim 34, wherein the vessel or workboat comprises hoisting means arranged to hoist the ROV onto a deck of the vessel and lower the ROV into the water from the vessel.

36. A vessel or workboat according to claim 34 or 35, wherein the control unit may be arranged on the vessel, enabling an operator to control the submergible cleaning system and the ROV.

37. A vessel or workboat according to any of the claims 34-36, wherein a storage unit is arranged on the vessel for storing data regarding the cleaning of the underwater hull surface.

38. Use of the submergible cleaning system according to any of the claims 1-33 for cleaning an underwater hull surface of a vessel while the vessel is afloat or an offshore facility such as for instance an offshore installation, an oil rig or an offshore wind turbine.