CLAIMS

1. A robot configured to clean a surface of a coating applied to a hull of a vessel whilst travelling over said hull, the robot comprising:

a cleaning brush assembly which comprises a cleaning brush, the cleaning brush being arranged to rotate about its axis to apply a cleaning action to the surface when it is in contact with the surface, wherein the cleaning brush comprises bristles having a bristle length, the bristles having a bristle diameter of 1 mm or less;

wherein the robot is configured to apply a degree of compression of the cleaning brush on the surface such that the cleaning brush is held in a position a distance towards the surface of the coating, away from an initial position at which the cleaning brush is in contact with, but not deformed by, the surface of the coating, wherein said distance is less than 20% of the bristle length of the bristles.

2. The robot of claim 1, wherein said distance is 2-16% of the bristle length of the bristles, and more preferably 2-12% of the bristle length of the bristles.

3. The robot of claim 1 or 2, wherein the bristles have a bristle diameter of 0.2 to 0.75 mm, preferably 0.3 to 0.6 mm.

4. The robot of any preceding claim, wherein the bristles of the cleaning brush are arranged in a plurality of tufts mounted to a core of the cleaning brush.

5. The robot of claim 4, further comprising a processor configured to control the robot to travel over an area of the hull such that each tuft of bristles applies a number of brush strokes during said cleaning action to said area wherein said area has a width of 5mm and a length corresponding to a length of the cleaning brush.

6. The robot of claim 5, wherein the number of brush strokes is less than 1710, preferably 5 to 1280, more preferably 6 to 1280 and yet more preferably 6 to 855.

7. The robot of any of claim 1 to 3, wherein the bristles of the cleaning brush are arranged in a plurality of brush strips.

8. The robot of claim 7, further comprising a processor configured to control the robot to travel over an area of the hull such that each brush strip applies a number of brush strokes during said cleaning action to said area, wherein said area has a width of 5mm and a length corresponding to a length of the cleaning brush.

9. The robot of claim 8, wherein the number of brush strokes is less than 1710, preferably 5 to 1280, more preferably 6 to 1280 and yet more preferably 6 to 855.

10. A robot configured to clean a surface of a coating applied to a hull of a vessel whilst travelling over said hull, the robot comprising:

a cleaning brush assembly which comprises a cleaning brush, the cleaning brush being arranged to rotate about its axis to apply a cleaning action to the surface when it is in contact with the surface, wherein the cleaning brush comprises bristles having a bristle length, the bristles having a bristle diameter of 0.5 to 2mm;

wherein the robot is configured to apply a degree of compression of the cleaning brush on the surface such that the cleaning brush is held in a position a distance towards the surface of the coating, away from an initial position at which the cleaning brush is in contact with, but not deformed by, the surface of the coating, wherein said distance is 4 to 60% of the bristle length of the bristles.

11. The robot of claim 10, wherein said distance is 4 to 48% of the bristle length of the bristles, and more preferably 4-28% of the bristle length of the bristles.

12. The robot of claim 10 or 11, wherein the bristles have a bristle diameter of 0.5 to 1.5 mm.

13. The robot of any of claim 10 to 12, wherein the bristles of the cleaning brush are arranged in a plurality of tufts mounted to a core of the cleaning brush.

14. The robot of claim 13, further comprising a processor configured to control the robot to travel over an area of the hull such that each tuft of bristles applies a number of brush strokes during said cleaning action to said area, wherein said area has a width of 5mm and a length corresponding to a length of the cleaning brush.

15. The robot of any of claim 10 to 12, wherein the bristles of the cleaning brush are arranged in a plurality of brush strips.

16. The robot of claim 15, further comprising a processor configured to control the robot to travel over an area of the hull such that each brush strip applies a number of brush strokes during said cleaning action to said area, wherein said area has a width of 5mm and a length corresponding to a length of the cleaning brush.

17. The robot of claim 14 or 16, wherein the number of brush strokes is less than 17,000, preferably 5 to 12,000, more preferably 6 to 10,000 and still more preferably 6 to 5000.

18. The robot of any preceding claim, wherein the cleaning brush assembly comprises a brush position adjustment mechanism for controlling said degree of compression.

19. The robot of claim 18, wherein the brush position adjustment mechanism is manually adjustable to control said degree of compression.

20. The robot of claim 18, wherein the brush position adjustment mechanism is coupled to a processor, wherein the processor is configured to communicate with the brush position adjustment mechanism to control said degree of compression.

21. The robot of any preceding claim, further comprising a processor configured to:

determine a location of the robot on the hull of the vessel;

query a memory coupled to said processor to identify a further coating applied to the hull of the vessel at said location; and

determine that the robot requires reconfiguration based on the identified further coating.

22. The robot of claim 21, wherein the processor is configured to determine a location of the robot on the hull of the vessel based on receiving location data from at least one of:

a location sensor on the robot;

a location sensor on the vessel, the robot comprising a communication interface for receiving the location data from said location sensor; and

a computing device, the robot configured to receive the location data from the computing device via said communication interface.

23. The robot of any preceding claim, further comprising a processor configured to:

determine a degree of fouling on the surface of a coating; and

determine that the robot requires reconfiguration based on the degree of fouling.

24. The robot of any of claims 21 or 23, wherein the processor is configured to control the robot to travel to a robot docking station on the vessel in response to the determination that the robot requires reconfiguration.

25. The robot of claim 24, wherein the brush position adjustment mechanism is coupled to said processor, and the processor is configured to communicate with the brush position adjustment mechanism to vary said degree of compression in response to the determination that the robot requires reconfiguration.

26. The robot of claim 23, wherein the processor is configured to determine a degree of fouling on the surface of a coating based on receiving fouling data from at least one of:

a fouling sensor on the robot;

a fouling sensor on the vessel, the robot comprising a communication interface for receiving the fouling data from said fouling sensor; and

a computing device, the robot configured to receive the fouling data from the computing device via said communication interface.

27. A kit for cleaning the hull of a vessel, the kit comprising:

a robot configured to clean a surface of a coating applied to the hull of a vessel whilst travelling over said hull, the robot comprising a mechanism for coupling a cleaning brush to the robot; and

one or more cleaning brush;

wherein the one or more cleaning brush comprises:

a lamellar cleaning brush comprising a plurality of lamellas extending outwardly from a brush core and having a height, wherein the robot is configured, when the lamellar cleaning brush is coupled to said mechanism, to apply a degree of compression of the lamellar cleaning brush on the surface such that the lamellar cleaning brush is held in a position a distance towards the surface of the coating, away from an initial position at which the lamellar cleaning brush is in contact with, but not deformed by, the surface of the coating, wherein said distance is less than 56% of the height of the plurality of lamellas.

a first bristle cleaning brush comprising bristles having a bristle length, the bristles having a bristle diameter of 1 mm or less, wherein the robot is configured, when the first bristle cleaning brush is coupled to said mechanism, to apply a degree of compression of the first cleaning brush on the surface such that the first bristle cleaning brush is held in a

position a distance towards the surface of the coating, away from an initial position at which the first bristle cleaning brush is in contact with, but not deformed by, the surface of the coating, wherein said distance is less than 20% of the bristle length of the bristles.

a second bristle cleaning brush comprising bristles having a bristle length, the bristles having a bristle diameter of 0.5 to 2mm, wherein the robot is configured, when the second bristle cleaning brush is coupled to said mechanism, to apply a degree of compression of the second cleaning brush on the surface such that the second bristle cleaning brush is held in a position a distance towards the surface of the coating, away from an initial position at which the cleaning brush is in contact with, but not deformed by, the surface of the coating, wherein said distance is 4 to 60% of the bristle length of the bristles.

28. A method of cleaning a surface of a coating applied to a hull of a vessel, wherein the coating has a König pendulum hardness between 30 to 74 counts, the method comprising:

coupling a cleaning brush to a robot, wherein the cleaning brush comprises bristles having a bristle length, the bristles having a bristle diameter of 1 mm or less;

configuring the robot to apply a degree of compression of the cleaning brush on the surface such that the cleaning brush is held in a position a distance towards the surface of the coating, away from an initial position at which the cleaning brush is in contact with, but not deformed by, the surface of the coating, wherein said distance is less than 20% of the bristle length of the bristles;

positioning the robot on the hull of the vessel; and

controlling the robot to travel to across said surface, the cleaning brush being arranged to rotate about its axis to apply a cleaning action to the surface when it is in contact with the surface.

29. A method of cleaning a surface of a coating applied to a hull of a vessel, wherein the coating has a König pendulum hardness greater than or equal to 75 counts, the method comprising:

coupling a cleaning brush to a robot, wherein the cleaning brush comprises bristles having a bristle length, the bristles having a bristle diameter of 0.5 to 2mm;

configuring the robot to apply a degree of compression of the cleaning brush on the surface such that the cleaning brush is held in a position a distance towards the surface of the coating, away from an initial position at which the cleaning brush is in contact with, but not deformed by, the surface of the coating, wherein said distance is 4 to 60% of the bristle length of the bristles;

positioning the robot on the hull of the vessel; and

controlling the robot to travel to across said surface, the cleaning brush being arranged to rotate about its axis to apply a cleaning action to the surface when it is in contact with the surface.