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(54) APPARATUS FOR CLEANING AND/OR APPLYING PRESERVATIVES

(71) I, PAUL HAMMELMANN, a German citizen of 17 Zum Sundern, 474 Oelde/Westphalia, Germany, 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:—

The invention relates to an apparatus for cleaning and/or applying preservatives to vertical or inclined surfaces, especially ships' sides, and having a carriage arranged to be mountable, in use, on a rail at the upper edge of a dry dock and arranged, when so mounted, to be displaceable along the rail, a mast which can be pivoted about a horizontal axis, and an implement-carrier mounted at the free end of the mast.

An apparatus of this kind has been proposed in German Patent Specification No. 2,134,281. This apparatus has an implement-carrier which is adjustable with respect to a carriage mounted on a dock, and which is equipped with a guide means which holds an implement in a horizontal position during the movement of the mast. The implement can be displaced horizontally in relation to the rest of the apparatus. The apparatus has a control device which, starting at a constant speed of advance of the carriage, controls drive means for horizontally moving the implement and for moving the carrier up and down so that, during the main part of the upward and downward movement of the carrier, the implement is moved horizontally at the same speed as, but in the direction opposite to the travel of the carriage. The implement is slowed down at the ends of the upward and downward movements so that the width over which the apparatus operates in the direction of travel of the carriage can be adjusted. During the pivotal movement of the mast about a horizontal axis, the implement travels over a circular path.

The apparatus shown in German Patent Specification No. 2,134,281 has a horizontal pivot shaft for the mast, which shaft is disposed so that it will be approximately halfway up the sides of the ships brought into

the dock. The length of the mast can therefore be kept small. The apparatus can be readily provided with auxiliary control or operating equipment and can be easily supplied with fuel for operating it and cleaning or preservative substances, since there is no need for the path of travel of the carriage to extend into the dock as there is in the case of other prior art apparatus which is displaceable along the floor of the dock. The positioning of the operating elements on the upper edge of the dock ensures easy supervision.

However, in the apparatus shown in German Patent Specification No. 2,134,281, the implement cannot be brought into the bows and stern zones of the ship, so that these zones have to be cleaned and treated with preservative using other equipment.

An aim of the present invention is to provide an apparatus by means of which the outer surfaces of the bows and stern of the ship can be readily treated.

According to the invention, there is provided an apparatus for cleaning, or applying preservatives to, vertical or inclined surfaces and having a carriage arranged to be mountable, in use, on a rail at or adjacent to the upper edge of a dock and arranged, when so mounted, to be displaceable along the rail, a jib supported by the carriage and pivotable about an axis which, when the carriage is mounted on the rail, is vertical, a mast carried by the jib and pivotable about a pair of axes which, when the carriage is mounted on the rail, are respectively vertical and horizontal, and an implement-carrier mounted at the free end of the mast.

The carriage preferably has a depending frame with means which engages a lower second rail on the side of a dry dock when the carriage is mounted on the rail at the upper edge of the dock. By pivoting the jib relatively to the carriage about a vertical axis and by pivoting the mast about a vertical axis located at the forward end of the jib, it is then possible to move the implement over a considerable distance into the

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interior of the dock, so that the implement can also be moved to the outer zones of the bows or stern of a ship to be cleaned or to which preservative is to be applied.

- 5 The length of the jib and the length of the mast, as well as the angles of pivoting about the said vertical axes are preferably so selected that the implement is positioned in the middle of the dock when a maximum
10 pivoting movement in the horizontal plane takes place.

In an advantageous embodiment of the invention, the implement carrier is in the form of a basket and is mounted to rotate
15 about an axis relatively to the mast. Furthermore an implement, such as a spraying means, mounted on the carrier is pivotable about an axis relatively to the basket-like carrier, the pivot axis of the implement being
20 perpendicular to the said axis of rotation of the basket-like carrier.

This multi-directional displaceability of the implement in relation to the mast or in relation to the carriage results in it becoming possible to bring the implement adjacent
25 to the surface to be treated and to hold it against this surface during travel of the apparatus along the ship, by means of a control device fitted with probe means for sensing the surface to be treated.
30

During travel of the apparatus along the hull of the ship to be cleaned or treated with preservative, the mast can be swung upwards and downwards about a horizontal
35 axis. It is however also possible to adjust the implement vertically to a given level and to move it along the surface to be treated, so that horizontal bands are treated each time. At the end of the surface to be treated,
40 the implement is positioned to deal with the adjacent horizontal band.

Examples of the apparatus in accordance with the invention are illustrated in the attached drawings and will now be described.

45 In the drawings:

Fig. 1 is a view, in side elevation, of an apparatus in accordance with the invention shown mounted for displacement along the
50 upper edge of a dock and along the dock wall, two positions of the mast being shown.

Fig. 2 is a plan view of the apparatus shown in Fig. 1.

Fig. 3 is a front view of the apparatus with an implement disposed in a position
55 corresponding to the middle of the dock.

Fig. 4 is a view, in side elevation, of a modified form of the carriage of the apparatus shown in Fig. 1.

Fig. 5 is a view in the direction of the
60 arrow V of Fig. 4.

Fig. 6 shows a section on the line VI—VI of Fig. 4.

Fig. 7 is a view, on a larger scale, of part of the apparatus shown in Fig. 4.

Fig. 8 is a front view of the detail seen in Fig. 7.

Fig. 9 is a view, on a larger scale, of part of the apparatus seen in Fig. 6 and

Fig. 10 is a circuit diagram of the hydraulic system for controlling the mast, for moving the implement relatively to the basket-like carrier, and for moving the latter relatively to the mast.

The apparatus for cleaning and/or applying preservatives to the sides of a ship comprises a carriage 1 having a vertical part 10 and a horizontal part 2 which is mounted for displacement on a rail 3 which is fixed to a T-section 4 firmly secured to the upper edge 5 of a dry dock. More specifically, the carriage has sets of rollers 6 which are arranged at the lateral ends of the horizontal part 2 of the carriage and co-operate with the rail 3 and the T-section 4. Each set of rollers comprises upper support rollers 7 and horizontal support rollers 8 which engage the rail 3, and a roller 9 which moves over the lower face of the upper flange of the T-section 4.

The vertical part 10 of the carriage moves parallel to wall 11 of the dock and is in the form of a downwardly-tapering frame. Rotatably mounted in a lower cross-beam 12 of this frame are rollers 13 which run on the upper flange of a T-shaped rail 14 secured to the wall of the dock.

At its upper and lower ends and in its median plane, the carriage is equipped with bearing plates 15 and 16, and 17 and 18, respectively, in which a jib 19 is mounted to pivot about a vertical axis 20. As will be seen from Fig. 2, the maximum pivot angle is 180°.

Seen from the side, the jib 19 constitutes a trapezium-shaped frame. Piston-and-cylinder units 21 and 22, which are, for example, hydraulically powered, are provided for pivoting the jib 19.

The piston-and-cylinder unit 21 is pivotally linked at the point 23 to the vertical part 10 of the carriage and has a piston rod 24, the free end of which is linked to a bracket 25 at the point 26. The bracket 25 is mounted to swivel about the axis 20 and is coupled to the piston-and-cylinder unit 22, the free end of the piston rod of this unit engaging a strap 27 on the jib 19. If the piston rod of the unit 21 is moved outwardly with respect to its cylinder, then the bracket 25 moves in the counter-clockwise direction as viewed in Fig. 2, and drives the jib 19 with the piston-and-cylinder unit 22 acting as a coupling member. The maximum pivot angle of the jib that can be effected by means of the piston-and-cylinder unit 21 is 90°. The end of the pivoting attainable by means of the piston-and-cylinder unit 21 is illustrated in Fig. 2 in broken lines and is perpendicular to the dock wall 11. Displace-

ment through a further 90° is achieved by actuating the piston-and-cylinder unit 22. If the piston rod is moved fully out of its cylinder, the jib 19 occupies the other jib position shown in broken lines in Fig. 2.

Provided on the shorter front side 28 of the trapezium constituting the jib 19 is a pivot bearing 29 by means of which a mast 30 can be pivoted about a vertical axis 31. This pivoting movement is effected by piston-and-cylinder units 32 provided at the two sides of the jib 19.

The mast can also be pivoted about a horizontal axis 33 by means of a piston-and-cylinder unit 34. In the construction illustrated, the pivoting about this axis extends over an angle of 130°. At its free end the mast has a basket-like carrier 35 for an implement. This implement may be a hydraulically powered spray-pipe 48 or a bar 50 which is provided with paint-spraying nozzles 49 and which may be secured to a jib 51 of a holder 52 for the spray pipe. The implement can be kept horizontal in any position of the mast 30. To obtain arcuate bands of paint etc. of similar width during pivoting movement of the mast about the horizontal axis 33, the implement moves at the same speed as the carriage, but in the opposite direction. At the ends of the swinging movement of the mast 30, the implement is slowed down so that it moves on to the adjoining band to be treated.

It is however also possible to use the implement for applying a horizontal band of paint etc. to the surface to be treated, e.g. to the side of a ship. For this purpose the spray-pipe or the bar carrying the paint-spraying nozzles is adjusted vertically to a given level. The apparatus is then moved along the hull of the ship. Thereafter, the implement is raised or lowered to deal with the adjacent band.

In the form of construction described, the dimensions of the jib 19 and the mast 30, as well as the degree of pivoting of these parts are so selected that the implement can be moved to the middle 36 of the dock. The mast 30 can be swivelled about its vertical axis 31 through an angle of 45° relatively to the jib 19.

In the form of construction shown in Figs. 4, 5 and 6, the horizontal part of the carriage is provided at the lateral ends with sets of rollers 37 which engage a rail 38 secured to the upper edge of the dock.

As seen in side elevation, the vertical part of the carriage consists of a rectangular frame 39 and a downwardly tapering frame 40. At the zone where the frame 39 joins the frame 40 there are provided sets of supporting rollers 41 and 42 which co-operate with a rail 43 secured to the vertical wall of the dock. The lower end of the frame 40 is provided with supporting rollers 44 which

move over a rail 45 secured to the wall of the dock.

The carriage has a bifurcated element 46, for supporting and guiding a cable running to a winch, and also has a fixing device for a cable firmly secured to a ship.

It is thus possible to provide the apparatus with a winch for pulling a ship into the dock so that separate pulling means can be dispensed with.

In this forms of construction, the piston-and-cylinder unit 34 for moving the mast about the vertical axis 31 enables the mast to be pivoted relatively to the jib 19 through 45° and in both directions.

The basket-like carrier 35 for the spray pipe 48 and bar 50 is rotatable relatively to the mast 30 about the axis of the holder 52, e.g. through 15° in one direction and 80° in the other, said rotation being achieved with the aid of a piston-and-cylinder unit 53 which is only illustrated in the circuit diagram of Fig. 10. The spraying-nozzle bars 48 and 50 can be swivelled relatively to the basket-like carrier 35 about an axis 54 with the aid of a piston-and-cylinder unit 55. The range of swivel is 5° in one direction and 35° in the other in the present embodiment.

Pressurized oil required for the automatic control operations behind the rear faces of the pistons 56, 57 and 58, respectively is continuously applied to the parts of the piston-and-cylinder units 32, 55 and 53. For manual operation, a three-way magnetically operated valve 59, 60 or 61 is provided for each of the movements, each valve causing pressurized oil to be supplied to or discharged from the parts of the cylinders, of the respective piston-and-cylinder units in advance of the front piston faces 56a, 57a and 58a to initiate the various movements.

The magnetically operated cut-off valves 62, 63 and 64, which are preferably actuated only by electric contacts in order to avoid operational errors, connect the operating ducts of probe valves 65, 66 and 67 to pressurized oil when energised, these latter valves being fitted with probe rollers 56a, 66a and 67a and mounted on the holder 52. When the magnetically operated cut-off valves are actuated, all three movements of the implement are in the direction of the object to be treated and they continue until the probe valves stop the movements or start them off in the opposite directions.

All end positions are controlled by means of limit switches in order to prevent the maximum desirable distances of travel from being exceeded.

WHAT I CLAIM IS:—

1. An apparatus for cleaning, or applying preservatives to, vertical or inclined surfaces and having a carriage arranged to be mountable, in use, on a rail at or adjacent

ment through a further 90° is achieved by actuating the piston-and-cylinder unit 22. If the piston rod is moved fully out of its cylinder, the jib 19 occupies the other jib position shown in broken lines in Fig. 2.

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WHAT I CLAIM IS:—

1. An apparatus for cleaning, or applying preservatives to, vertical or inclined surfaces and having a carriage arranged to be mountable, in use, on a rail at or adjacent



- to the upper edge of a dock and arranged, when as mounted, to be displaceable along the rail a jib supported by the carriage and pivotable about an axis which, when the carriage is mounted on the rail, is vertical, a mast carried by the jib and pivotable about a pair of axes which, when the carriage is mounted on the rail, are respectively vertical and horizontal, and an implement-carrier mounted at the free end of the mast.
2. An apparatus according to claim 1, wherein the jib is pivotable through substantially 180° about the vertical axis.
3. An apparatus according to claim 2, wherein the jib is coupled by way of a piston-and-cylinder unit to a bracket which is mounted to rotate about the vertical pivot axis of the jib and which is pivotable through 90° about said pivot axis by means of a piston-and-cylinder unit linked to the carriage.
4. An apparatus according to claim 1, wherein the implement carrier is of basket-like form and is rotatable relatively to the mast by means of a piston-and-cylinder unit.
5. An apparatus according to claim 4, wherein an implement is mounted on the basket-like carrier and is pivotable relatively to the carrier about a vertical axis by means of a piston-and-cylinder unit.
6. An apparatus according to any one of the preceding claims, wherein the carriage includes means for pulling ships and means for guiding a cable for securing the apparatus to the ship.
7. An apparatus according to claim 1 or claim 4, wherein the jib is trapezium-shaped and has a longer side adjacent the carriage and a shorter side, the mast being pivotally mounted on a bearing at the shorter side of the trapezium.
8. A dry dock having a rail at or adjacent to the upper edge thereof and an apparatus according to any preceding claim, wherein the carriage has a horizontal part displaceably mounted on the rail, and a frame-like vertical part which extends substantially parallel to the wall of the dock and which carries bearings by means of which the jib is pivotally mounted.
9. A dry dock according to claim 8, wherein the length of the jib and of the mast, as well as the angles through which they may be pivoted, permits the implement carrier to be moved substantially to the middle of the dock.
10. A dry dock according to claim 8 or 9, wherein a rail is provided on the wall of the dock and the horizontal and vertical parts of the carriage are provided with sets of rollers supported on the rails.
11. A dry dock according to claim 10, wherein the sets of rollers of the vertical part of the carriage are disposed at the lower end and in the upper half thereof.
12. A dry dock substantially as herein described with reference to the accompanying drawings.
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