

A DREDGE HOPPER DOOR SUPPORT AND ALIGNMENT DEVICE

BACKGROUND

The present invention relates to a dredge hopper door support and alignment device for supporting a dredge hopper door during maintenance procedure that often needs to be performed.

Dredging vessels of a kind which are used to dredge the bottom of waterways, channels or other submarine surfaces include a holding compartment for holding the materials that have been dredged up. From Figure 1 which is a sectional view in the direction of the center line of part of a dredging vessel it can be seen that the vessel includes a holding compartment 1. Dredging apparatus such as a continuous chain of buckets or scoops or a suction device, will bring such materials on board be temporarily stored in the storage compartment 1. A dredger of the kind as shown in Figure 1 includes an opening at the bottom of the compartment 1 through which the collected material can be discharged. The opening 2 is able to be closed by a door 9 or series of doors. These doors are in a position to close the opening during the collection of the material which is to be temporarily stored in the compartment. The doors can be opened to thereby allow the material to be discharged from the hopper. The doors are engaged to a mechanism 3 which can manipulate the movements of the doors. The doors are engaged to the hull 4 of the vessel by hinges 6 and hence are pivotable relative to the hull about an axis defined by the hinge pins at the hinges 6.

The loading that the doors will experience during operation of the vessel means that the doors and the hinges are of a significant size. The doors are hence of a strong construction and often weigh in the order of 6 to 12 tons.

Accordingly the loading that is placed on the hinge pins is also significant. Furthermore because the environment in which the hinges exist is a wet environment which also includes a lot of suspended solid material such as sand or rocks, the hinge pins are subjected to a lot of wear and tear. Because of such wear and tear, both the doors as well as the hinge pins are often required to be serviced. The servicing of the hinge pin (which on occasion can include a complete replacement of the hinge pin) requires the removal of the doors from the vessel.

The vessel needs to go into dry dock in order to allow for the doors to be removed. Currently the removal of the doors is achieved by the use of block and tackle. Temporarily anchor points may need to be welded onto the upper surfaces of a door panel to allow for the block and tackle to engage with the door. Block and tackle is usually suspended from a structure above the doors and by which the weight of the doors can be taken up by thereby. Once the weight has been

taken up by the block and tackle, the hinge pins can be safely removed without the doors becoming violently dislodged from the vessel. However with the use of block and tackle, accidents still can occur especially if the forces are not in equilibrium. Should the loading taken up by the block and tackle not hold the door panels in an equilibrium position then once the hinge pin is removed, the doors may still swing or move suddenly. This can cause injuries. For the reinstallation of the doors with the vessel the block and tackle is again used. It can be very time consuming to manipulate the door panels to a position relative to the vessel so that the hinge pins can be inserted to complete the assembly. For removal, the doors also need to be removed from underneath the vessel. In a dry dock situation the clearance between the bottom of the vessel 7 and the ground 8 is often restricted. It is not uncommon for this clearance to be in the order of 1.5m and such a small clearance makes the freedom of manipulation of the door panels more restrictive. The door panels are normally of a width which is greater than the clearance between the vessel and the ground and hence the door panels, and as shown in Figure 1 cannot move to a condition where they hang substantially vertically below the pivoted axis of the hinge 6. This hence makes the manipulation of the doors for assembly and this assembly more complicated and time consuming.

Accordingly it is an object of the present invention to provide a dredge hopper door support and alignment device which will overcome the abovementioned difficulties or which will at least provide the public with a useful choice.

BRIEF DESCRIPTION OF THE INVENTION

In a first aspect the present invention consists in a dredge hopper door support device for a dredge hopper door of a kind which includes a hinge structure at one edge thereof which in use is pivotably engaged about a pivot axis to a complementary hinge structure of and at the bottom of a hull of a dredging vessel to allow movement of the door to open and close a hopper of said vessel, said support device to support to said door when said vessel is in dry dock by it being able to be positioned under the vessel for engagement with said door, said device comprising:

a rolling base structure able to move horizontally on a supporting surface below said door and along a first axis of movement,

a cradle disposed from said rolling base structure, said cradle comprising:

1. a first support means presenting a bearing surface to provide vertical support to the bottom surface of said door at or proximate to the edge of said door opposite to the edge of said hinge structure,
2. a second support means spaced from said first support means and which presents a bearing surface to provide vertical support to said door at a bottom surface thereof proximate to the edge of said door where said hinge structure is provided said bearing surface of second support being vertically higher than said bearing surface of said first support to thereby provide support to said door on incline to the horizontal when viewed in the direction of said pivot axis,
3. a third support means which presents a bearing surface to engage the edge of said door opposite to the edge of said hinge structure, said third support capable of movement in a horizontal direction relative to said second support to thereby control the horizontal positioning of the edge of said door opposite to the edge of said hinge members relative to the second support and to thereby control the vertical (parallel to a second axis) and horizontal positioning of the edge where said hinge structure is provided.

Preferably said cradle is a unit structure and engaged as a unit with said rolling base structure.

Preferably said cradle comprises of said first second and third support means individually engaged to said rolling base structure.

Preferably said rolling base structure is a fabricated frame.

Preferably said third support means horizontal movement is along an axis parallel to the first axis of movement.

Preferably said cradle is supported on top of said rolling base structure.

Preferably said third support means is movable relative to said second support means in its horizontal direction whilst said first support means remains stationary relative to said second support means.

Preferably said first support means and said third support means are movable in said horizontal direction of said third support means and relative to said second support means as a unit.

Preferably said bearing surface of said second support means is provided by a means rotatable.

Preferably said means rotatable is a wheel or roller bearing having a horizontal axis of rotation which is transverse to said horizontal direction in which said third support means is capable of moving.

Preferably said second support means remains stationary relative to said rolling base structure.

Preferably said rolling base structure is able to move in a second horizontal direction being transverse to the first axis of movement of said rolling base structure.

Preferably said bearing surface of said first support means is able to move relative to said rolling base structure in a horizontal direction (hereinafter the "third axis") which is transverse to the first axis to allow movement of the door parallel to said third axis.

Preferably said bearing surface of said third support means is able to move relative to said rolling base structure in a horizontal direction (hereinafter the "third axis") which is transverse to the first axis to allow movement of the door parallel to said third axis.

Preferably said bearing surface of said second support means is able to move relative to said rolling base structure in a horizontal direction (hereinafter the "third axis") which is transverse to the first axis to allow movement of the door parallel to said third axis.

Preferably said first and third support means are able to move in a horizontal direction transverse to the first mentioned direction of movement of said third support means relative to said rolling base structure and relative to said second support means.

Preferably the bearing surface of said second support means is able to be adjusted in height relative to the bearing surface of said first support means.

Preferably the bearing surface of said second support means is able to be adjusted in height relative to rolling base structure.

Preferably said rolling base structure is provided with means to allow its movement parallel to said third axis.

Preferably said rolling base structure is provided with wheels to aid in its movement over a supporting surface.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partial sectional view of a hull of a vessel in a dry dock showing the doors at the bottom of the storage compartment,

Figure 2 is a partial section view of a hull of a vessel including a door and wherein a support device for the door has been engaged with the door,

Figure 3 illustrates a support device of the present invention in a side view and showing the position of a door therewith, and wherein the position of the door has been illustrated in two other conditions,

Figure 4 is a perspective view of an illustrative drawing of the support device of the present invention,

Figure 5 is an end view of the support device of the present invention,

Figure 6 is a plan view of the support device of the present invention,

Figure 7 is a perspective view as an illustrative drawing of part of the support device of the present invention,

Figure 8 is a perspective view of an illustrative drawing of part of the support device of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

With reference to Figure 2 there is shown in part a hull 4 of a dredger or barge which is being held above and supported by the floor of a dry dock 8. The hull includes a door 9 which is able to close an opening 2, to a compartment 1 of a dredger. The door is pivotable about a pivot axis defined by a hinge pin 6 and can swing about the hinge pin relative to the hull 4. The door is substantially square or rectangular when viewed in plan. The space between the bottom of the hull and the floor of the dry dock is normally limited and is normally not greater than the height of a person. By way of example the height is or may be in the order of 1.5m. Of course it is possible in some instances to raise the height of the bottom of the hull relative to the floor of the dry dock, but for safety reasons it is desirable to keep the hull as proximate as possible to the floor of the dry dock.

The support device 10 of the present invention is able to be positioned intermediate of the floor of the dry dock and the bottom of the hull. The support device 10 is hence of a height which is less than the space between the hull and the floor of the dry dock at a region of the hull where it is to engage with the door. The support device includes a rolling base structure 11. The rolling base structure is for example a frame fabricated from a steel beam or sheet material and has disposed therefrom, wheels 12. The wheels 12 allow for the support device 10 to move over the floor 8 of the dry dock with limited resistance. In the most preferred form, engagement of the support device with the door is achieved by moving the support device in a direction parallel to the direction X. The direction X is preferably substantially perpendicular to the axis of rotation of the door relative to the hull of the vessel. Engagement of the support device with the door is such as to position the support device substantially below the door. The support device may in addition or alternatively be movable to be engaged with the door from a different direction such as in direction Z, this direction being normal to both the X and Y direction and being substantially parallel to the axis of rotation of the door relative to the hull about the hinge pin 6. Complete freedom of movement in all directions across the floor 8 of the dry dock may be provided by wheels which are castor wheels which are dependant from the frame of the rolling base structure. It will be appreciated by a person skilled in the art that alternative forms of rolling engagement of the support device with the surface 8 of the dry dock can be achieved. A sufficient number of wheels 12 will need to be disposed from the frame of the rolling base structure and located in an appropriate positions so as to provide an adequate support when the support device of the present invention is in a condition where it is carrying the weight of the door.

The most preferred movement direction of the support means to place at in conjunction with the door is in the X direction since the door is most conveniently removed from the hull when it extends from its pivot axis at the hinge pin 6 in a downwardly sloping direction.

Once the rolling base structure is in position proximate to the door, support means which are carried by the rolling base structure can be adjusted so that contact with and support by the support means can be made with the door. With reference to Figure 4 there is shown as a conceptual diagram, the support device of the present invention wherein a first support means 14 provides a bearing surface which provides vertical support (in direction Y) to the bottom surface of the door. Such vertical support is provided to the bottom surface of the door at or approximate to that edge of the door which is away from the hinge structure 16 where the hinge pin engages the door to the hull. The first support means 14 and as with reference to Figure 3, can support a door 9 at its edge 16 which is the edge opposite to the edge proximate most to the hinge structure 16. In the most preferred form the bearing surface of the first support means is planar and substantially parallel to the X-Z plane. In other words it is substantially horizontal when the rolling base structure is supported on a horizontal surface.

In order to provide stable support to the door, a second support means 15 is provided. The second support means 15 is also dependently supported by the rolling base structure. The second support means includes a bearing surface which is able to engage with and provide vertical support to the door by being engagable to the bottom surface of a door. The bearing surface of the second support means is able to engage with the door at a location which is spaced from the contact point of the bearing surface of the first support means 14. Indeed it is most preferred that the second support means bearing surface engages with a bottom surface of the door proximate to the hinge structure. There are preferably two support means provided and the second support means are preferably provided in the form of legs that project upwardly from the rolling base structure. The second support means in such a form provides vertical support to the door at at least two points separated in the Z direction and this will aid in the provision of stability. A third support means 13 is provided and is dependent from the rolling base structure to provide a means for locating the support device with the door in a horizontal (X direction) direction. The third support means 13 effectively provides support to any horizontal movement of the door relative to the rolling base structure.

In use, the support structure of the present invention will provide support to a door when it is still engaged to the hull of the vessel by the hinge pin. Such support will be provided for example when the door is extending downwardly from the hull away from the hinge pin as for

example the direction shown in Figure 2. An adjustment of the position of the door relative to the hull of the vessel is able to be achieved by the support devices of the present invention. When the door is to be disengaged or engaged with the hull it is important that the hinge structure 16 of the door can be moved in several and preferably all directions so that an alignment can be achieved. Such alignment is important to position the hinge structure of the door proximate to the hinge structure of the hull to allow for a hinge pin to be inserted. Such alignment is also important so that the support device of the present invention will support the weight of the door and remove such weight from being supported by the hinge pin to thereby allow for the hinge pin to be removed when the door is to be removed from the hull of the vessel.

Once the door is engaged by and at the first, second and third means of the support structure, movement of the first, second and/or third support means is possible to thereby control the positional movement of the hinge structure 16. When such adjustment is being made it is desirable that the rolling base structure remains stationary relative to the ground although some adjustment (e.g. a course adjustment may be able to be made by the movement of the rolling base structure over the surface of the dry dock). Such movement may preferably be in the X direction but may also be in the Z direction. However most preferably the base structure will remain stationary when adjustment of the position of the hinge structure 16 of the door is being made.

Movement of the first, second and/or third support means relative to rolling base structure can be such as to manipulate the position of the hinge structure 16 of the door and the X, Y and/or Z directions.

Movement of the location of the hinge structure 16 can be adjusted by a movement of the second support means but with reference to Figure 3, it can be seen that the second support means includes a base member 20 which is engaged (whether directly or indirectly) to the rolling base structure 11. The base member supports a movable member 21 which can move in a direction which is preferably substantially vertical (in the Y direction). This movable member 21 carries with it the bearing surface which is provided in the form of a wheel 22 which is rotatable about an axis parallel to the Z direction. It will be appreciated that although the movement of the movable member 21 relative to the base member 20 is in the Y direction, the movement may also have a component in the X direction. Assuming that the edge 16 of the door remains substantially stationary, when the movable member 21 of the second support means 15 travel upwardly, the movement of the hinge structure 16 will be substantially along an arc having a center at the edge 16. The movement of the hinge structure hence has a component in the X and Y direction. The wheel 22 will be able to travel along part of the lower surface of the door as the movable section

21 of the second support means travels in the Y direction. It hence aids in the relative movement of the second support means 15 to the door. The wheel may alternatively have an axis of rotation parallel to the X-Y plane and an axis which remains parallel to the surface of the door. Ball bearing bearing surfaces may be provided instead.

A hydraulic ram 25 may be provided intermediate of the base member 20 and the movable member 21 to allow for the bearing surface provided by the wheel 22 to move relative to the rolling base structure.

Further movement of the hinge structure 16 in the X and Y direction may be provided by the third support means 13. The third support means 13, acting against an edge of the door, is preferably provided to move relative to the rolling base structure in the X direction. The third support means 13 in moving in the X direction will displace the edge 16 in the X direction relative to the rolling base structure. This means that the bearing surface of the second support means remains stationary, the movement of the third support means 13 towards the second support means will displace the hinge 16 and both the X and Y direction. The hinge moves up in the Y direction and for a certain distance to the left and X direction.

Movement of the third support means 13 in the X direction is preferably controlled by a hydraulic ram or rams 26 which are positioned between a fixed portion of the rolling base structure and the third support means. The hydraulic rams control the relative distance between the first support and third support means 13 in the X direction. The first support means may move by the use of bearings provided between the rolling base structure and the third support means 13. Such bearings 27 are for example roller bearings which are able to roll along a track of the rolling base structure 11.

With reference to Figure 6, it can be seen that the first 14 and third support means 13 are movable in the X direction as a unit. In the simplified drawing of Figure 4, it can be seen that the first and third support means are substantially a unit which can move in the X direction together. This would mean that in moving the edge 16 in the X direction by the third support means, the edge 16 will also remain substantially stationary relative to the first support means 14. In the alternative form as shown in Figure 7 the third support means 13 is able to move relative to the first support means 14. In the configuration as shown in Figure 7, the first support means 14 may indeed be a surface which remains stationary and may hence be considered part of the rolling base structure 11. However in such a configuration, a sliding movement of the edge 16 of the door would result over the first support means.

It may indeed be that the third support means 13 includes a movable bearing surface which whilst some of the first support surface remains stationary relative to the rolling base structure, the bearing surface is able to move with the door.

To assist in the position of the hinge structure of the door with the complimentary hinge and structure of the vessel, adjustment of the door may also be necessary in the Z direction. Whilst the rolling base structure may be able to accommodate movement of the door in the Z direction by rolling over the surface of the dry dock, in the preferred form, the support means are also provided with the ability to allow for the door to be displaced in the Z direction relative to the rolling base structure 11. The first support means 14 may for example be of a configuration where the bearing surface can be displaced in the Z direction. Such a configuration may for example provided by a conveyor belt like arrangement wherein a conveyor belt like structure is provided to roll around end sprockets 29. A hydraulic ram 30 for example may allow for such a displacement to occur. Alternatively the bearing surface of the first support means may be movable by a hydraulic ram which extends between the rolling base structure and the first support means (similar to the configuration of the rams 26 to move the first support means 14 in the X direction). The third support means may also be movable in the Z direction as a unit with the movement of the first support means or may remain stationary relative thereto. The third support means 13 may include a bearing surface which itself is movable in the Z direction whereas a base structure of the third support means 13 remains stationary relative to the rolling base structure.

For the purposes of flexibility of configuration and for the purposes to allow for flexibility in the support device to be positionable relative to the door structure, some additional features have been provided. With reference to Figures 3 and 5, it can be seen that the second support means 15 are movable from a substantially vertical condition to a horizontal condition by a provision of an axle 33 about which the second support means can rotate relative to the rolling base structure.

Likewise the third support means, with reference to Figure 3, is shown to be collapsible to move the bearings surface thereof to a substantially horizontal condition. Such features of movement of the support means may be desirable to allow for the device of the present invention to become positioned relative to the door section particularly where there is relative smaller space for movement.

CLAIMS

1. A dredge hopper door support device for a dredge hopper door of a kind which includes a hinge structure at one edge thereof which in use is pivotably engaged about a pivot axis to a complementary hinge structure of and at the bottom of a hull of a dredging vessel to allow movement of the door to open and close a hopper of said vessel, said support device to support to said door when said vessel is in dry dock by it being able to be positioned under the vessel for engagement with said door, said device comprising:

a rolling base structure able to move horizontally on a supporting surface below said door and along a first axis of movement,

a cradle disposed from said rolling base structure, said cradle comprising:

- (a) a first support means presenting a bearing surface to provide vertical support to the bottom surface of said door at or proximate to the edge of said door opposite to the edge of said hinge structure,
- (b) a second support means spaced from said first support means and which presents a bearing surface to provide vertical support to said door at a bottom surface thereof proximate to the edge of said door where said hinge structure is provided said bearing surface of second support being vertically higher than said bearing surface of said first support to thereby provide support to said door on incline to the horizontal when viewed in the direction of said pivot axis,
- (c) a third support means which presents a bearing surface to engage the edge of said door opposite to the edge of said hinge structure, said third support capable of movement in a horizontal direction relative to said second support to thereby control the horizontal positioning of the edge of said door opposite to the edge of said hinge members relative to the second support and to

thereby control the vertical (parallel to a second axis) and horizontal positioning of the edge where said hinge structure is provided.

2. A device as claimed in claim 1 wherein said cradle is a unit structure and engaged as a unit with said rolling base structure.
3. A device as claimed in claim 1 wherein said cradle comprises of said first second and third support means individually engaged to said rolling base structure.
4. A device as claimed in any one of claims 1 to 3 wherein said rolling base structure is a fabricated frame.
5. A device as claimed in any one of claims 1 to 4 wherein said third support means horizontal movement is along an axis parallel to the first axis of movement.
6. A device as claimed in any one of claims 1 to 5 wherein said cradle is supported on top of said rolling base structure.
7. A device as claimed in any one of claims 1 to 6 wherein said third support means is movable relative to said second support means in its horizontal direction whilst said first support means remains stationary relative to said second support means.
8. A device as claimed in any one of claims 1 to 6 wherein said first support means and said third support means are movable in said horizontal direction of said third support means and relative to said second support means as a unit.
9. A device as claimed in any one of claims 1 to 6 wherein said bearing surface of said second support means is provided by a means rotatable.
10. A device as claimed in claim 9 wherein said means rotatable is a wheel or roller bearing having a horizontal axis of rotation which is transverse to said horizontal direction in which said third support means is capable of moving.
11. A device as claimed in any one of claims 1 to 10 wherein said second support means remains stationary relative to said rolling base structure.

12. A device as claimed in any one of claims 1 to 11 wherein said rolling base structure is able to move in a second horizontal direction being transverse to the first axis of movement of said rolling base structure.
13. A device as claimed in any one of claims 1 to 12 wherein said bearing surface of said first support means is able to move relative to said rolling base structure in a horizontal direction (hereinafter the "third axis") which is transverse to the first axis to allow movement of the door parallel to said third axis.
14. A device as claimed in any one of claims 1 to 13 wherein said bearing surface of said third support means is able to move relative to said rolling base structure in a horizontal direction (hereinafter the "third axis") which is transverse to the first axis to allow movement of the door parallel to said third axis.
15. A device as claimed in any one of claims 1 to 14 wherein said bearing surface of said second support means is able to move relative to said rolling base structure in a horizontal direction (hereinafter the "third axis") which is transverse to the first axis to allow movement of the door parallel to said third axis.
16. A device as claimed in any one of claims 1 to 15 wherein said first and third support means are able to move in a horizontal direction transverse to the first mentioned direction of movement of said third support means relative to said rolling base structure and relative to said second support means.
17. A device as claimed in any one of claims 1 to 16 wherein the bearing surface of said second support means is able to be adjusted in height relative to the bearing surface of said first support means.
18. A device as claimed in any one of claims 1 to 17 wherein the bearing surface of said second support means is able to be adjusted in height relative to rolling base structure.

19. A device as claimed in any one of claims 1 to 18 wherein said rolling base structure is provided with means to allow its movement parallel to said third axis.
20. A device as claimed in any one of claims 1 to 19 wherein said rolling base structure is provided with wheels to aid in its movement over a supporting surface.