

VESSEL ACCESS DEVICE

FIELD OF INVENTION

- 5 The present invention relates to aquatic vessels and particularly to a hull door for such vessels.

BACKGROUND

- 10 It is known for vessels for maritime use, or more generally for aquatic use, to have a hinged or pivotally mounted door which is moveable between a closed, or sea-going, position and an open position in which the door provides access into a hull interior and forms a ramp or platform for facilitating loading and unloading of cargo, vehicles and/or passengers, for example. In some known arrangements, the door seals a
- 15 watertight bulkhead when in the closed position. Vessels have been provided with such doors in the bow, stern or sides of the vessel hull. For example, in the so-called 'ro-ro' ferries stern and/or bow doors provide for rapid roll-on roll-off loading and unloading of vehicles.
- 20 In previous arrangements the reach of a door which folds down to provide a single span ramp is often inadequate. For example, when a vessel is brought up to a sloping beach, a door which hinges downward and outward to provide a single span ramp can be too short to reach from the vessel to the beach above the waterline. It is known to extend the reach of a ramp by deployment of one or more pivotally-mounted ramp
- 25 sections. The additional sections are used to span greater distances between the vessel and a quay, wharf, jetty, beach, etc. However, a substantial space is required to accommodate the additional spans when in a stowed, i.e. sea-going, configuration. These arrangements are therefore only suitable for relatively large vessels.
- 30 When a vessel has a conventional propeller at or near the stern of the vessel and the vessel is to be brought into a shallow area, such as when embarking or disembarking at a beach, it is desirable for the vessel to approach the beach bow first. This allows the bow, having a relatively shallower draught, to approach the beach while keeping

the deeper draught of the stern, and the propeller, in deeper water. In this case, it is desirable to have the access door/ramp at the bow of the vessel. However, the bow is typically finer than the stern which leaves a relatively small space to accommodate a bow door/ramp and its support mechanism within the confines of the hull while
5 maintaining a streamlined hull form when the door/ramp is closed.

In many known systems, outer clam doors or a bow visor are used to close over the bow door or ramp to form the normal external bow shape of the vessel and to provide a first layer of protection from seas when sailing. Clam doors and visors are
10 vulnerable to excessive loadings from heavy seas and therefore require substantial mountings and lock systems. This is particularly so where heavy seas act against the clam door or visor in an opening rather than a closing direction. Many failures and accidents involving clam doors and visors have been reported.

15 In other known bow door arrangements, the bow shape of the vessel hull is compromised to accommodate the bow door. Installation of a bow door involves the competing requirements of a fine bow form to maintain seagoing performance, particularly at high speed, and an adequate width of the bow access opening into the hull interior.

20

Hence, it is accordingly an object of the present invention to provide an apparatus for providing a vessel door providing for access and egress into a vessel hull interior which addresses at least some the abovementioned disadvantages or which will at least provide the public with a useful choice.

25

BRIEF DESCRIPTION OF THE INVENTION

In a first aspect the present invention may be broadly said to be a hull access device for an aquatic vessel, the device consisting at least in part of:

- 30 a hull access portion for forming part of a hull of the vessel, and
 first, second and third connecting means,
wherein:

the first connecting means is for pivotal attachment to a major portion of said hull at a first axis,

the bow portion is pivotally attached to the first connecting means at a moveable second axis, the second axis being moveable perpendicularly to the second axis along a substantially circular first path when the first connecting means pivots about the first axis at the pivotal attachment to the major hull portion,

the second connecting means is pivotally attached to the first connecting means at a moveable third axis, the third axis lying between the first and second axes and being moveable perpendicularly to the third axis along a substantially circular second path when the first connecting means pivots about the first axis,

the third connecting means is pivotally connected to the second connecting means at a moveable fourth axis, the fourth axis being moveable but substantially constrained to movement perpendicular to the fourth axis along a third path,

the hull access portion is pivotally attached to the third connecting means at a moveable fifth axis, and

the first, second, third, fourth and fifth axes are spaced apart from one another and are substantially parallel to one another.

Preferably the perpendicular distance between the third and fourth axes is substantially equal to the perpendicular distance between the second and fifth axes, and the perpendicular distance between the second and third axes is substantially equal to the perpendicular distance between the fourth and fifth axes.

The third path may be rectilinear, and the first fixed axis may lie on the longitudinal axis of the rectilinear third path.

Each of the first, second and third connecting means may be formed by a respective pair of first and second connecting members, the first connecting members of the first, second and third connecting means lying substantially in a first plane, the second connecting members of the first, second and third connecting means lying substantially in a second plane, and the first and second planes being spaced apart and mutually parallel. The first and second planes are preferably arranged symmetrically on port and starboard sides of a fore and aft centreline of said hull.

The hull access portion is preferably shaped to be closeable over an opening in the major portion of said hull and, when so closed, to form in combination with the major portion an exterior hull form with a streamlined shape.

5

Preferably, the hull access portion is a bow portion which is shaped to form in combination with the major hull portion an exterior hull form with a streamlined tapered bow shape.

10 In a second aspect the present invention may be broadly said to be an aquatic vessel consisting at least in part of:

a major hull portion,

a bow portion which is moveable, relative to the major hull portion, between a first configuration in which the bow portion substantially closes an opening in the major hull portion, and a second configuration in which the bow portion extends forwardly from the major hull portion, and

15

first, second and third connecting means,

wherein:

the first connecting means is pivotally attached to the major hull portion at a fixed first axis,

20

the hull access portion is pivotally attached to the first connecting means at a moveable second axis, the second axis being moveable perpendicularly to the second axis along a substantially circular first path when the first connecting means pivots about the first axis,

25

the second connecting means is pivotally attached to the first connecting means at a moveable third axis, the third axis lying between the first and second axes and being moveable perpendicularly to the third axis along a substantially circular second path when the first connecting means pivots about the first axis,

30

the third connecting means is pivotally connected to the second connecting means at a moveable fourth axis, the fourth axis being moveable but substantially constrained to movement perpendicular to the fourth axis along a third path,

the hull access portion is pivotally attached to the third connecting means at a moveable fifth axis, and

the first, second, third, fourth and fifth axes are spaced apart from one another and are substantially parallel to one another.

5 Preferably the perpendicular distance between the third and fourth axes is substantially equal to the perpendicular distance between the second and fifth axes, and the perpendicular distance between the second and third axes is substantially equal to the perpendicular distance between the fourth and fifth axes.

10 The third path may be rectilinear, and the first fixed axis may lie on the longitudinal axis of the rectilinear third path.

15 Each of the first, second and third connecting means is formed by a respective pair of first and second connecting members, the first connecting members of the first, second and third connecting means lying substantially in a first plane, the second connecting members of the first, second and third connecting means lying substantially in a second plane, and the first and second planes being spaced apart and mutually parallel. The first and second planes are preferably arranged symmetrically on port and starboard sides of a fore and aft centreline of said major hull portion.

20 The hull access portion is preferably shaped to be closeable over the opening and, when so closed, to form in combination with the major hull portion, an exterior hull form with a streamlined shape. Preferably the hull access portion is a bow portion and the streamlined shape is a tapered bow shape.

25 The hull access portion, when in the second configuration, may form a ramp, platform or stairway which facilitates access and egress to the interior of the vessel hull via the opening.

30 This invention may also be broadly said to consist in the parts, elements and features referred to or indicated herein, individually or collectively, including any or all combinations of any two or more of said parts, elements or features. Where specific integers mentioned herein have known equivalents in the art to which this invention

relates, such known equivalents are deemed to be incorporated herein as if specifically set forth.

BRIEF DESCRIPTION OF THE DRAWINGS

5

A preferred form of the present invention will now be described with reference to the accompanying drawings in which:-

Figure 1 shows a perspective view of a forward portion of a vessel hull having
10 a bow access device shown in an opened position,

Figure 2 shows a port side elevation of the hull portion shown in Figure 1, but with the bow access device shown in a closed position,

Figure 3 shows a plan view of the hull portion shown in Figures 1 and 2,

Figure 4 is a diagrammatic side view of the hull portion as seen at centreline
15 A-A of Figure 3, and

Figure 5 is a magnification of the hull portion seen within circle B of Figure 4.

DETAILED DESCRIPTION OF THE INVENTION

20 The figures show a forward portion of the hull of an aquatic vessel having a device which provides for access and egress to and from a hull interior via a closeable opening that is provided toward the bow of the vessel. The device shown is primarily a bow door which is closeable over the opening and openable to allow access and egress to and from the hull interior through the opening. The device also provides a
25 surface for use as a pathway during such access and egress.

A vessel has a major hull portion 1 and a bow portion 2. The bow portion is shown in the figures in a closed position 2A, a first mid-position 2B, a second mid-position 2C, and an open position 2D; the mid-position being partway between the closed and
30 open positions. The major hull portion has an opening 4 at a forward end thereof.

As may be best appreciated from Figure 4, the bow portion 2 is moveable, relative to the major hull portion 1, between the closed configuration 2A in which the bow

portion substantially closes the opening 4, and the open configuration 2D in which the bow portion extends forwardly from the major hull portion. Figure 4 also shows the bow portion in the intermediate position 2B.

- 5 As may be best appreciated from Figure 1, the bow portion 2 is supported by port and starboard sets of rigid but pivotally connected links. The sets of links are pivotally attached at opposite sides of the bow portion to flank the opening 4 into the vessel interior. The bow portion opens by swinging on the links to move downward and forward from the closed position 2A to the open position 2D, and in reverse to close
10 back over the vessel hull opening 4.

The following description is of first, second, and third connecting means. Each of these three connecting means comprises a respective pair of substantially similar port and starboard connecting links which are symmetrically configured and arranged
15 about the fore and aft centreline A-A (seen in Figure 3) of the vessel hull. As will be further described below, the links of each pair pivot about common mutually parallel axes.

Figures 4 and 5, being views at the centreline A-A, show the first, second and third
20 starboard connecting links 6S, 8S, 10S. These starboard links are also shown in Figure 1, which also shows the first port connecting link 6P and the third port connecting link 10P. The second port connecting link is not shown in the figures.

??? The bow portion 2 and the three starboard connecting links 6S, 8S, 10S are
25 shown in Figures 4 and 5 in dotted, dot-dashed, and continuous lines to indicate the bow portion in the closed 2A, midway 2B, 2C and open 2D positions, respectively.

The first connecting means comprises the first starboard connecting link 6S and first port connecting link 6P. These first starboard and port links are pivotally attached to
30 the major hull portion 1 at a fixed first axis 12. The bow portion 2 is pivotally attached to each of the first starboard and port connecting links at a moveable second axis 14. This second axis is moveable perpendicularly to the second axis along a

substantially circular first path 16 when the first connecting means pivots about the first axis.

5 The second connecting means comprises the second starboard connecting link 8S and second port connecting link (not shown). These second starboard and port second links are pivotally attached to the respective starboard and port first links 6S, 6P of the first connecting means at a moveable third axis 18. This third axis lies between the first axis 12 and the second axis 14. The third axis is moveable perpendicularly to the third axis along a substantially circular second path 20 when the first connecting
10 means pivots about the first axis 12.

The third connecting means comprises the third starboard connecting link 10S and third port connecting link 10P. These third starboard and port third links are pivotally attached to the respective starboard and port second links of the second connecting
15 means at a moveable fourth axis 22. This fourth axis is moveable but is substantially constrained to move perpendicular to the fourth axis only along a rectilinear third path 24.

20 The bow portion 2 is pivotally attached to the third connecting links 10S, 10P at a moveable fifth axis 26. This fifth axis 26 is moveable perpendicular to the fifth axis along a curvilinear fourth path 28.

25 The first, second, third, fourth and fifth axes 12, 14, 18, 22, 26 are substantially parallel to one another.

In the preferred embodiment, and as shown in the figures, the perpendicular distance between the third axis 18 and the fourth axis 22 is substantially equal to the perpendicular distance between the second axis 14 and the fifth axis 26. The perpendicular distance between the second axis 14 and third axis 18 is substantially
30 equal to the perpendicular distance between the fourth axis 22 and the fifth axis 26.

The fixed first axis 12 preferably lies on the longitudinal axis 29 of the rectilinear third path 24, as shown in Figures 4 and 5.

As noted above, each of the first, second and third connecting means is formed by a respective pair of first and second connecting members or links, and in the embodiment shown these are arranged symmetrically as port and starboard links on
5 respective sides of a fore and aft centreline.

Each of the respective first connecting links 6S, 8S, 10S of the first, second and third connecting means lies substantially in a first plane on the starboard side of the centreline A-A of the hull, as seen in the plan view of Figure 3. The three first
10 connecting links 6S, 8S, 10S together with the bow portion 2 form a first parallelogram or pantograph.

Each of the respective second connecting links (only 6P and 10P being shown in Figure 1) of the first, second and third connecting means lies substantially in a second
15 plane, which is parallel with and spaced apart from the first plane and on a port side of the centreline A-A, as seen in the plan view of Figure 3. The three second connecting links together with the bow portion 2 form a second parallelogram or pantograph which is dimensioned substantially the same as the first pantograph.

20 The first and second planes are preferably arranged symmetrically on port and starboard sides of the fore and aft hull centreline A-A.

The two pantographs together support the bow portion 2. The bow portion has pad-eyes or lugs by which the bow portion is respectively and pivotally connected to the
25 lower ends of the first and third connecting links. The pantograph of connecting links allows the bow portion 2 to swing further forward from the major hull portion 1 than if it were simply swung about a single pivotal axis.

The two pantographs are pivotally mounted to the major portion of the hull at
30 respective pivotal attachments on the fixed first axis 12 and on respective sides of a passageway leading to the opening 4 at the forward end of the major hull portion 1.

In each pantograph, a pivot pin is fixed to one or other of the second and third connecting links to provide the pivotal connection at the fourth axis 22. The pin runs along a straight slot in an elongate plate fixed to the major portion of the hull to constrain the fourth axis to move along the rectilinear path 24.

5

The bow portion 2 is shaped to be closeable over the opening 4. When the bow portion is closed over the opening, i.e. when in the first configuration 2A (and as best seen in Figure 4), the bow portion 2 forms, in combination with the major hull portion 1, a hull form with a streamlined tapered bow shape that does not detract from a good seagoing performance of the vessel, and particularly at higher forward speeds. The bow portion and major hull portion are provided with complementary shapes which meet closely along an abutment line to provide fair exterior lines to the vessel hull.

10 The bow portion opens outwardly and downwardly to the open configuration 2D. The exact angle of the opened bow portion relative to the major hull portion can be adjusted to suit the height of the beach or other surface at which embarkation or disembarkation is to take place. When the bow portion is opened the upper surface 30 forms a platform when substantially horizontal, or a ramp when inclined as shown as the fully open, or second, configuration 2D in Figure 4. Alternatively, the surface may be shaped with steps to provide a stairway to facilitate access to and egress from the interior of the vessel hull.

15 The substantially horizontal junction between the bottom of the closed bow portion 2A and the major hull portion 1 has a somewhat V-shape with port and starboard flanks meeting at a bow stem. As may be best appreciated from Figure 5, the aft-most ends of this V-shape of the bow portion follow a curvilinear path similar to curvilinear path 28. In particular, as the bow portion 2 opens from closed position 2A, through mid-positions 2B, 2C, to open position 2D, the aft-most lower parts of the of the bow portion 2 move forward, initially downwardly, then substantially horizontally, then upwardly. At the same time, the lower end of the stem of the bow portion 2 moves downward and forward along a somewhat different curvilinear path. The effect is for the aft ends of the port and starboard sides of the V-shaped bow portion to initially

25
30

move downward to clear the major hull portion and then, after moving forward, to rise upward and flank the narrowing forward section of the major hull portion.

During the initial opening phase, the whole bow portion moves downward and
5 forward away from the major hull portion. However, during the latter opening phase the bow portion pivots, about a notional axis provided by the pantographs, with the aft ends of the port and starboard sides of the V-shape moving upward while the forward parts of the bow portion continue to move downward.

10 Correspondingly, on closing, the bow portion initially pivots about the notional axis but then finally closes against the major hull portion with a substantially linear motion in an upward and rearward direction. This substantially linear closing movement of the bow portion simplifies the provision of a watertight seal between the closed bow
portion and the major hull portion.

15 The bow portion 2 can be moved between the opened and closed configurations by an actuator, not shown, or manually. In one arrangement, and as shown in Figures 1 and 4, port and starboard lines 32, 34 are attached to the inside of the distal end of the bow portion 2 and fed through respective fairleads 36, 38, or over respective pulleys, at
20 corresponding locations at the top of the opening 4 in the major hull portion 1. A winch powered manually or by a drive motor can be used to slacken the lines so that the bow portion drops outward under its own weight to the open position 2D, or to tension the lines to raise the bow portion and maintain it in its closed position 2A. It is to be noted that a mid-portion of the port line 32 has been omitted in Figure 4 to
25 reveal the starboard pantograph more clearly.

Although the invention has been described by way of example and with reference to particular embodiments, it is to be understood that modifications and/or improvements may be made without departing from the scope or spirit of the
30 invention. For one example, a bow portion as described above may be provided in either one or both hulls of a catamaran vessel. For another example, the bow portion and the major hull portion are provided with sealing means, such as sealing rims which, when the bow portion closes, compress resilient rubber gaskets. A double set

of rim and gasket pairs may be used to provide a double seal to reduce the likelihood of water entering the hull through the opening when the bow portion is closed.

5 For one more example, a portable or rotatable bridging step or platform (not shown) can be provided between the major hull portion 1 and the upper surface 30 of bow portion 2, to create a smooth passage or walk way when the bow portion 2 is opened at position 2D.

10 Furthermore, the invention is particularly advantageous for use as a bow access device where the constraints of space at the relatively narrow bow sections of a vessel hull give little room to fit a door/ramp that has an adequately long reach. However, the invention is also suitable for use as a stern access device or as a port or starboard side access device.

15 Still further, the rectilinear constraint of the moveable fourth axis 22 can be replaced by constraining the fourth axis to move only along a circular path. The fourth axis can be provided at the distal ends of a pair of port and starboard radial arms that are pivotally attached to respective fixed points on the hull 1.

LIST OF FEATURES LABELLED IN THE DRAWINGS

	major hull portion 1		moveable third axis 18
	bow portion 2		circular second path 20
	bow in closed position 2A		moveable fourth axis 22
5	bow in mid-positions 2B, 2C		rectilinear third path 24
	bow in open position 2D	20	moveable fifth axis 26
	opening 4		curvilinear fourth path 28
	first starboard connecting link 6S		longitudinal axis 29
	second starboard connecting link 8S		upper surface 30
10	third starboard connecting link 10S		port line 32
	first port connecting link 6P	25	starboard line 34
	third port connecting link 10P		fairlead 36
	fixed first axis 12		fairlead 38
	moveable second axis 14		fore and aft centreline A-A
15	circular first path 16		
30			

CLAIMS

1. A hull access device for an aquatic vessel, the device consisting at least in part of:

5 a hull access portion for forming part of a hull of the vessel, and
first, second and third connecting means,

wherein:

the first connecting means is for pivotal attachment to a major portion of said hull at a first axis,

10 the hull access portion is pivotally attached to the first connecting means at a moveable second axis, the second axis being moveable perpendicularly to the second axis along a substantially circular first path when the first connecting means pivots about the first axis at the pivotal attachment to the major hull portion,

the second connecting means is pivotally attached to the first connecting
15 means at a moveable third axis, the third axis lying between the first and second axes and being moveable perpendicularly to the third axis along a substantially circular second path when the first connecting means pivots about the first axis,

the third connecting means is pivotally connected to the second connecting means at a moveable fourth axis, the fourth axis being moveable but substantially
20 constrained to movement perpendicular to the fourth axis along a third path,

the hull access portion is pivotally attached to the third connecting means at a moveable fifth axis, and

the first, second, third, fourth and fifth axes are spaced apart from one another and are substantially parallel to one another.

25

2. A hull access device as claimed in claim 1, wherein the perpendicular distance between the third and fourth axes is substantially equal to the perpendicular distance between the second and fifth axes, and the perpendicular distance between the second and third axes is substantially equal to the perpendicular distance between the fourth
30 and fifth axes.

3. A hull access device as claimed in claim 1 or 2, wherein the third path is rectilinear.

4. A hull access device as claimed in claim 3, wherein the first fixed axis lies on the longitudinal axis of the rectilinear third path.

5 5. A hull access device as claimed in any one of the preceding claims, wherein each of the first, second and third connecting means is formed by a respective pair of first and second connecting members, the first connecting members of the first, second and third connecting means lying substantially in a first plane, the second connecting members of the first, second and third connecting means lying
10 substantially in a second plane, and the first and second planes being spaced apart and mutually parallel.

6. A hull access device as claimed in claim 5, wherein the first and second planes are arranged symmetrically on port and starboard sides of a fore and aft centreline of
15 said hull.

7. A hull access device as claimed in any one of the preceding claims, wherein the hull access portion is shaped to be closeable over an opening in the major portion of said hull and, when so closed, to form in combination with the major portion an
20 exterior hull form with a streamlined shape.

8. A hull access device as claimed in any one of the preceding claims, wherein the hull access portion is a bow portion which is shaped to form in combination with the major hull portion an exterior hull form with a streamlined tapered bow shape.
25

9. An aquatic vessel consisting at least in part of:
a major hull portion,
a hull access portion which is moveable, relative to the major hull portion,
between a first configuration in which the hull access portion substantially closes an
30 opening in the major hull portion, and a second configuration in which the hull access portion extends outwardly from the major hull portion, and
first, second and third connecting means,
wherein:

the first connecting means is pivotally attached to the major hull portion at a fixed first axis,

the hull access portion is pivotally attached to the first connecting means at a moveable second axis, the second axis being moveable perpendicularly to the second axis along a substantially circular first path when the first connecting means pivots about the first axis,

the second connecting means is pivotally attached to the first connecting means at a moveable third axis, the third axis lying between the first and second axes and being moveable perpendicularly to the third axis along a substantially circular second path when the first connecting means pivots about the first axis,

the third connecting means is pivotally connected to the second connecting means at a moveable fourth axis, the fourth axis being moveable but substantially constrained to movement perpendicular to the fourth axis along a third path,

the hull access portion is pivotally attached to the third connecting means at a moveable fifth axis, and

the first, second, third, fourth and fifth axes are spaced apart from one another and are substantially parallel to one another.

10. An aquatic vessel as claimed in claim 9, wherein the perpendicular distance between the third and fourth axes is substantially equal to the perpendicular distance between the second and fifth axes, and the perpendicular distance between the second and third axes is substantially equal to the perpendicular distance between the fourth and fifth axes.

11. An aquatic vessel as claimed in claim 9 or 10, wherein the third path is rectilinear.

12. An aquatic vessel as claimed in claim 11, wherein the first fixed axis lies on the longitudinal axis of the rectilinear third path.

13. An aquatic vessel as claimed in any one of claims 9 to 12, wherein each of the first, second and third connecting means is formed by a respective pair of first and second connecting members, the first connecting members of the first, second and

third connecting means lying substantially in a first plane, the second connecting members of the first, second and third connecting means lying substantially in a second plane, and the first and second planes being spaced apart and mutually parallel.

5

14. An aquatic vessel as claimed in claim 13, wherein the first and second planes are arranged symmetrically on port and starboard sides of a fore and aft centreline of said major hull portion.

10 15. An aquatic vessel as claimed in any one of claims 9 to 14, wherein the hull access portion is shaped to be closeable over the opening and, when so closed, to form in combination with the major hull portion, an exterior hull form with a streamlined shape.

15 16. An aquatic vessel as claimed in claim 15, wherein the hull access portion is a bow portion and the streamlined shape is a tapered bow shape.

17. An aquatic vessel as claimed in any one of claims 9 to 16, wherein the hull access portion, when in the second configuration, forms a ramp, platform or stairway
20 which facilitates access and egress to the interior of the vessel hull via the opening.