Title Air supported vessel with starboard and port keel lines with their respective keel steps to prevent air leakage.

Introduction

The present invention relates to an air supported vessel with a basically V-shaped hull and where there is a discontinuous transition respectively between a starboard and a port keel part's respective keel steps and a V-shaped bow's bow step.

The background of the invention is that air supported vessels are an important part of future shipping as an alternative to achieve the strict emissions requirements that are coming. Air supported hulls have a significantly reduced hydrodynamic resistance compared to conventional comparable hulls. By further developing air supported hulls to reduce air loss from the air supported chamber, increase directional stability and reduce hydrodynamic turning resistance moment(s), it will help bringing air supported vessels to become an even more interesting option within the market for environmentally friendly shipping.

Background technology

Most of the air supported vessels on the market today are what are also called air cushion boats or "Hovercraft" and many of them can move on land and in water. They often have an inflatable skirt around the hull which is internally filled with air and creates a boundary for the air supported chamber which, with the help of an excess pressure, lifts the vessel, but there are also some designs of air cushion boats with fixed hulls also called Surface Effect Ship (SES) or " Sidewall Hovercraft". Such types of vessels have both an air cushion, like a hovercraft, and a hull like a conventional vessel. When the air cushion is in use, only a small part of the hull protrudes into the sea.

US 3.742.888 patent from 1973 deals with a soft, stable multi-chambered hull, which has a number of high-pressure chambers around the periphery. The hull has further included a valve slot which provides a means for emptying the continuously charged high pressure chamber. The high-pressure chambers under the boat provide soft

support with the air cushion and low friction. A disadvantage of such a hull, where there is so little buoyancy in the side walls of the high-pressure chambers, is that the vessel will lose stability as soon as the pressure in the air supported chambers drops or the fans for blowing in high-pressure air are switched off. The buoyancy elements are not in the keel itself, so the hull will also sink deeper into the water as soon as the high-pressure air is turned off. Another disadvantage of such a hull, where there is a deep longitudinal keel on starboard and port all the way from the stern and almost to the bow, is a high hydrodynamic turning resistance moment and great drag due to the length of the keel in the sea. There will also be a disadvantage with air discharge, in that high-pressure air is required and it will also require much more energy to lift the hull out of the water.

In US 3267898 patent from 1966, the air cushion fan is also used as a propulsion fan for the vessel. This will require much energy, both to lift the vessel and also to have enough thrust to propel the vessel forward. This patent is for a vessel that should be able to move both on water and on ice, like a sled by turning some longitudinal skirts 90 degrees, so they are lower than the keels. This invention will require too much energy to effectively move forward economically in relation to fuel consumption and thus indirectly in relation to today's environmental requirements.

US 3476069 patent from 1967 describes an air-cushioned vessel with a planing hull in the aft part and a front part which is delimited in whole or in part by a skirt. The aft part is delimited by two keel sections and the forward part is delimited by the flexible skirt.

British publication GB 2009677 A from 1979 relates to a vessel having an elongated hull, the bottom part of which consists of at least two longitudinal hull parts, each having a width less than half the width of the ship, and comprising means for pumping aur into the space between said longitudinal hull parts.

US 6293216 B1 patent from 2001 describes a deep-V hull configuration for a surface effective ship (SES) that utilize a cushion of pressurized air. The surface effect

vessel has an air cushion recess for containing the pressurized cushion of air that has a sloped transition area on a bow side edge. Water redirecting structure on the deep-V hull direct a turbulent water flow toward blow through areas of the air cushion recess and, thus, prevent air from escaping from the air cushion recess.

The Chinese utility model, CN 201761628 U, from 2011 relates to a high-speed V-shaped boat with a resistance-reducing air cavity, comprising a boat body, a propulsion system and an air supply system arranged in the boat body.

Another US 5415120 A publication from 1995 relates to a marine surface vessel that includes pressurized supporting gas cushions in multiple hulls, normally catamaran-like sidehulls, where such pressurized supporting gas cushions support a majority of boat weight in the operation.

The present invention generally aims to solve at least one, but preferably several, of the problems that exist from the prior art.

Brief summary of the invention

The invention is defined by the independent claim 1, where the invention is an air supported vessel comprising the following features,

- basically a V-shaped hull
- with a starboard keel part and a port keel part, and
- with a V-shaped bow, comprising an outer bow bearing surface,
- where the V-shaped hull has at least one air supported chamber in a significant part of the V-shaped hull's length below the waterline, characterized in
- where the air supported chamber is delimited by an air supported chamber ceiling, air supported chamber starboard and port side walls and with at least one aft closing device with an aft threshold which forms an aft delimitation of the air supported chamber and with at least one air supported chamber air intake which together with the side wall of the air supported chamber in the bow forms a front delimitation of the air supported chamber, wherein the V-shaped bow may further comprise a bow step with a bow step threshold, which extends from a starboard longitudinal keel step

around the V-shaped bow to a port longitudinal keel step, and form a lower delimitation of the air supported chamber's side wall in the bow, in order to reduce air leakage below a bow base line, and wherein

- a transverse step at an aft part of the bow base line, comprising a starboard transverse step and a port transverse step, where the starboard keel part with a starboard keel line and the port keel part a the port keel line have greater draft than the V-shaped bow with the bow base line at the starboard transverse step and the port transverse step.

In a further embodiment of the invention, the starboard keel part may comprise a starboard longitudinal keel step and a starboard keel threshold, which then forms a lower starboard lateral delimitation of the air supported chamber's starboard side wall, in order to reduce air leakage under a starboard keel line and the port keel part comprise a port longitudinal keel step and a port keel step threshold, which then forms a lower port lateral delimitation of the air supported chamber's port side wall, to reduce air leakage below a port keel line.

Advantages of the invention

An advantage of the invention on an air supported vessel where the lower part of the air supported chamber's starboard and port side walls are arranged with a longitudinal keel step on the starboard and port side respectively, is reduced air leakage from the air supported chamber under the keel step thresholds. The same advantage also applies to the V-shaped bow with the side wall of the air supported chamber bow with the bow step and the bow step threshold, which is reduced air leakage.

Another advantage of the invention on an air supported vessel where the V-shaped bow lies with reduced or very little water influence in operation, is that the V-shaped hull gets a better load distribution aft, which in turn gives a more advantageous ratio between lifting force and resistance on the keel parts of the V-shaped hull, on the starboard and port side, respectively Furthermore, it is an advantage of the invention that the two straight longitudinal keel parts on the starboard and port side,

respectively, which extend from the stern to slightly past the rear part of the V-shaped bow and with a greater draft than the V-shaped bow, provides good directional stability on the V-shaped hull, especially when waves slant in from the front or waves slant in from behind.

Further, inventive embodiments of the invention are indicated in the independent patent claims or in the description below.

Brief description of figures

Preferred embodiments of the invention will be described in more detail below with reference to the accompanying figures, in which:

Figure 0 shows a profile, also called an elevation, of the air supported vessel according to the present invention, which shows a longitudinal part of a basically V-shaped hull 0.0, seen from the outside towards starboard side.

Figure 1a shows a profile seen from the outside towards the starboard side of an embodiment of the basically V-shaped hull 0.0.

Figure 1b shows a sketch/outline of an embodiment of the basically V-shaped hull 0.0 seen towards the starboard or port side, as the V-shaped hull is symmetrical about a center line CL.

Figure 2a shows a bottom according to an embodiment of the basically V-shaped hull 0.0 and where an embodiment of a recess in the V-shaped hull 0.0 which forms the air supported chamber 5.0 with the air supported chamber ceiling 5.1 is also shown.

Figure 2b shows a sketch/outline of the bottom according to an embodiment of the basically V-shaped hull 0.0.

Figure 3a shows a profile of midship seen aft of an embodiment of the basically V-shaped hull 0.0.

Figure 3b shows a sketch/outline of the midship seen aft of an embodiment of the basically V-shaped hull 0.0.

Figure 4a shows a profile of the midship seen forward on an embodiment of the V-shaped hull 0.0.

Figure 4b shows a sketch/outline of the air supported vessel midship seen forward according to an embodiment of the basically V-shaped hull 0.0.

Figure 5 shows a sketch/outline of a longitudinal part at the starboard, or port, longitudinal keel step boundary 2.3.S/B according to an embodiment of the V-shaped hull 0.0.

Figure 6 shows a sketch/outline of two cross-sections marked A and B, according to figure 5, of an embodiment of the basically V-shaped hull 0.0, and where the sketch is marked with lines and reference numbers in order to name the parts of the V-shaped hull 0.0.

Figure 7 shows an embodiment of frame sections on a discontinuous transition 1.0.B on port side of the basically V-shaped hull 0.0, and where the V-shaped hull 0.0 is symmetrical about the center line CL, so corresponding embodiment of a discontinuous transition 1.0. S will be on the starboard side.

Figure 8a shows an embodiment of frame sections in the discontinuous transition area 1.0.B on port side of the V-shaped hull 0.0, seen obliquely from above the V-shaped bow part 3.0 towards the port keel part 2.1.B. The basically V-shaped hull 0.0 is symmetrical about the centerline, so such a design will also be on starboard side.

Figure 8b shows an embodiment of frame sections in the discontinuous transition area 1.0.B on port side of the basically V-shaped hull 0.0, seen obliquely from above the V-shaped bow section 3.0 towards the port keel part 2.1.B, and where the parts in the port discontinuous transition area 1.0.B is shaded in different designs to distinguish them more clearly from each other The basically V-shaped hull 0.0 is symmetrical about the centerline, so such a design will also be on the starboard side.

Figure 9a shows an embodiment of the frame sections in the discontinuous transition 1.0.B in a plan sketch, seen from the center line CL towards port side.

Figure 9b shows an embodiment of the frame sections in the discontinuous transition 1.0.B in a plan sketch, seen from the center line CL towards port side, and where the parts in the discontinuous transition are shaded to separate them from each other.

Figure 10 shows an embodiment of the frame sections in the discontinuous transition 1.0.B in a plan sketch, viewed from above and downwards on the basically V-shaped hull 0.0 on the port side.

Figure 11 shows an embodiment of the frame sections in the discontinuous transition 1.0.B in a plan sketch, seen from the centerline CL towards port side, and where a port side step secant 8.1.B is marked with a port side secant angle αB which shows an average rise of the port side the step profile 8.0.B. The hull is symmetrical about centerline CL, so a similar design is found on the starboard side.

Embodiments of the invention

The present invention bring about an air supported vessel comprising the following features,

- basically a V-shaped hull 0.0
- with a starboard keel part 2.1.S and a port keel part 2.1.B, and
- with a V-shaped bow 3.0 with a bow base line (BBL), comprising an outer bow bearing surface 3.3,
- where the basically V-shaped hull 0.0 has at least one air supported chamber 5.0 in a significant part of the basically V-shaped hull 0.0 length below the waterline,
- where the air supported chamber 5.0 is delimited by an air supported chamber ceiling 5.1, air supported chamber starboard and port side walls 5.2.S, 5.2.B and with at least one aft closing device 7.0 with aft threshold 7.1 which forms an aft delimitation of the air supported chamber 5.0 and with at least one air supported chamber air intake 5.3 which, together with the side wall of the air supported chamber in the bow 5.4, forms a front delimitation of the air supported chamber 5.0, wherein the V-shaped bow 3.0 may further comprise a bow step 3.1 with a bow step threshold 3.2, which extends from a starboard longitudinal keel step 2.2.S around the V-shaped bow 3.0 to a port longitudinal keel step 2.2.B, and form a lower delimitation of the air supported chamber's side wall in the bow 5.4, in order to reduce air leakage below a bow base line BBL,

and wherein a transverse step at an aft part of the bow base line BBL, comprising a starboard transverse step 4.0.S and a port transverse step 4.0.B, where the starboard keel part 2.1.S with a starboard keel line KL.S and the port keel part 2.1.B a the port keel line KL.B have greater draft than the V-shaped bow 3.0 with the bow base line BBL at the starboard transverse step 4.0.S and the port transverse step 4.0.B.

In one embodiment of the invention may the starboard keel part 2.1.S comprises a starboard longitudinal keel step 2.2.S and a starboard keel step threshold 2.3.S, which forms a lower starboard lateral delimitation of the air supported chamber's starboard side wall 5.2.S, to reduce air leakage below a starboard keel line KL. S, and the port keel part 2.1.B comprises a port longitudinal keel step 2.2.B and a port keel step threshold 2.3.B, which forms a lower port lateral delimitation of the air supported chamber's port side wall 5.2.B, to reduce air leakage below a port keel line KL. B.

In a further embodiment of the invention, the starboard keel part 2.1.S with the starboard keel line KL.S and the port keel part 2.1.B with the port keel line KL.B may have a greater draft than the V-shaped bow 3.0 with the bow baseline BBL.

According to one embodiment of the invention, a transition between the starboard longitudinal keel step 2.2.S and the starboard aft part of the bow step 1.4.S may be a starboard discontinuous transition 1.0.S, while being a transition between the port longitudinal keel step 2.2.B and port aft part of the bow step 1.4.B is a port discontinuous transition 1.0.B.

The term “discontinuous transition” is used to describe that the forward part of the relatively sharp keel lines of the keel steps 2.2.S, 2.2.B does not run over into the bow step 3.1, but extends forward and past the aft parts of the bow steps 1.4.S, 1.4.B, see especially Figure 8b, 9a and 9b.

In a further embodiment of the invention, the starboard discontinuous transition 1.0.S may extend from a forward starboard point 1.3.S on the starboard keel where the starboard longitudinal keel step 2.2.S runs over into the outer bow bearing surface 3.3 on the starboard side on an outside of the bow step 3.1, and aft to an aft starboard transition point 1.5.S on the starboard keel, where the bow step 3.1 runs over into the starboard longitudinal keel step 2.2.S, and there the port discontinuous transition 1.0.B may extend from a forward port point 1.3.B on the port keel where

the port longitudinal keel step 2.2.B runs over into the outer bow support surface 3.3 on the port side on an outside of the bow step 3.1, and aft to an aft port transition point 1.5.B on the port keel, where the bow step 3.1 on the port side runs over into the port longitudinal the keel step 2.2.B.

In a further embodiment of the invention, the discontinuous transition, respectively on the starboard and port side 1.0.S, 1.0.B, may form a straight line forward and which extends up and coincides in the outer bow bearing surface 3.3 on the starboard and port side respectively of the V-shaped bow 3.0.

In a further embodiment of the invention, the starboard discontinuous transition 1.0.S may comprise:

- a decreasing starboard keel step 1.1.S, and
- an outwardly sloping starboard keel surface 1.2.S, and
- the aft part of the starboard bow step 1.4.S, and
- a backward tapered starboard outphasing part 1.6.S of the outer bow bearing surface 3.3, on the starboard side, between the decreasing starboard keel step 1.1.S and the aft part of the starboard bow step 1.4.S, and where the port discontinuous transition (1.0.B) may include:
- a decreasing port keel step 1.1.B, and
- an outward sloping port keel surface 1.2.B, and
- the aft part of the port bow step 1.4.B, and
- a backward tapered port outphasing part 1.6.B of the outer bow bearing surface 3.3, on the port side, between the decreasing port keel step 1.1.B and the aft part of the port bow step 1.4.B.

The advantage of the discontinuous transitions, respectively on the starboard and port side, 1.0S, 1.0B is essentially improved directional stability on the V-shaped hull 0.0, in that the longitudinal keel steps on the starboard and port side respectively 2.2.S, 2.2.B extends straight ahead and turns up into the outer bow bearing surface 3.3, on the starboard and port side respectively. It is also an advantage that the geometrical design in the discontinuous transitions, on the starboard and port side

respectively, 1.0.S, 1.0.B with backward tapered starboard and port outphasing parts 1.6.S, 1.6.B, reduces air emissions from the air supported chamber 5.0 during propulsion by getting a relatively small flow of water into the backward narrowing starboard and port outphasing parts 1.6.S, 1.6.B, see Figure 8b.

Another advantage of the discontinuous transition, on the starboard and port sides, 1.0.S, 1.0.B respectively, is the straight tapered starboard and port keel steps 1.1.S, 1.1.B which are located on the outside of the aft parts of the starboard and port bow steps 1.4.S, 1.4.B, in such a way that any air loss below the bow step threshold 3.2 in the discontinuous transitions, on the starboard and port side 1.0.S, 1.0.B, respectively, is captured by a water flow into the backward tapered starboard and port side outphasing parts 1.6.S, 1.6.B during propulsion.

In one embodiment of the invention, the starboard discontinuous transition 1.0.S may comprise:
- a transverse starboard step 4.0.S, which is the difference between the design draft at the aft starboard transition point 1.5.S and design draft at the forward starboard point 1.3.S, and the port discontinuous transition 1.0.B may include:
- a transverse port step 4.0.B, which is the difference between the design draft at the aft port transition point 1.5.B and the design draft at the forward port point 1.3.B.

In a further embodiment of the invention, the V-shaped bow 3.0 may have a bow baseline BBL which is substantially horizontal in the forward direction from a transition between the bow step 3.1 or respectively the starboard longitudinal keel step 2.2.S and the port longitudinal keel step 2.2.B.

The advantages of having a transverse starboard and port step 4.0.S, 4.0.B, is to make the bow base line BBL to have a reduced draft in relation to the longitudinal keel steps on the starboard and port side 2.2.S, 2.2.B respectively, so that drag and wave resistance are reduced. Another advantage is that the hydrodynamic turning resistance moment is reduced by having a bow baseline BBL that has little draft.

In another embodiment of the invention, the V-shaped bow 3.0 may have a bow base line BBL with a slight fall forward calculated from a transition between the bow step 3.1, respectively the starboard longitudinal keel step 2.2.S or the port longitudinal keel step 2.2.B.

Such a design may help to increase buoyancy in the V-shaped bow 3.0, so that the vessel obtain better stability and may have a more flexible weight distribution on the main deck. Another advantage is that the bow base line BBL will be approximately horizontal when the vessel has an aft trim or when the vessel's bow rises in the sea during thrust, and will thus contribute to reduce the risk of air discharge below the bow threshold 3.2.

According to one embodiment of the invention, the starboard keel part 2.1.S may be parallel to the V-shaped hull's 0.0 centerline CL and where the port keel portion 2.1.B may be parallel to the V-shaped hull's 0.0 centerline CL.

By having two parallel keel parts, on the starboard and port side 2.1.S, 2.1.B respectively, around the V-shaped hull's 0.0 center line CL, the directional stability will be improved compared to the directional stability of a conventional V-hull, and especially against waves coming slanted in from the front or back. Lateral stability will also increase, the GZ curve, compared to a conventional V-hull.

In one embodiment of the invention, the stern threshold 7.1 may be adjustable in depth. Among other things, to be able to regulate the height of the air cushion in the air supported chamber 5.0.

In an embodiment of the invention, the outer bow bearing surface 3.3 can be outwardly inclined from the bow step 3.1, so that a vertical cross-section of the V-shaped bow section 3.0 is entirely or partially V-shaped, see for example the body plan at point 1.3.B in Figure 8a. The same applies for a vertical cross-section of the V-shaped hull 0.0 aft from the body plan at point 1.2.B in Figure 8a.

This contributes positively to the righting moment, the GZ curve, and is a significant advantage over US 3742888 from 1973.

In one embodiment of the invention, the air supported chamber side walls, on the starboard and port side 5.2.S, 5.2.B respectively, may be completely or partially, outwardly sloping.

In another embodiment of the invention, the side wall bow 5.4 of the air supported chamber may be completely or partially, outwardly inclined.

In a further embodiment of the invention, the longitudinal keel steps, respectively on the starboard and port side, 2.2.S, 2.2.B and the bow step 3.1 may be substantially vertical steps.

The entirely or partially air supported chamber side walls, respectively on the starboard and port side, 5.2.S, 5.2.B help to give the V-shaped hull 0.0 buoyancy and stability when the vessel is at rest and there is no supply of air to the air supported chamber 5.0 . The vertical longitudinal keel steps, respectively on the starboard and port side, 2.2.S, 2.2.B and the bow step, which sits on the lower edge of the air supported chamber side walls 5.2.S, 5.2.B, 5.4, are an obstacle for air to escape below the threshold on the vertical longitudinal keel steps, respectively on the starboard and port side, 2.2.S, 2.2.B and the threshold on the bow step 3.1.

In an embodiment of the invention, the V-shaped bow 3.0, comprising the bow step 3.1, may extend aft to the aft starboard, and respectively the aft port, transition point 1.5.S, 1.5.B which is located near the middle 0.5 x CWL of a construction water line KVL. By pulling the V-shaped bow section in CWL 3.4 close to the middle of the construction waterline CWL, there is less hydrodynamic turning resistance moment(s).

In another embodiment of the invention, the starboard longitudinal keel step 2.2.S can extend forward to the forward starboard point 1.3.S in front of the aft starboard

transition point 1.5.S, and where the port longitudinal keel step 2.2.B may extend forward to the forward the port side point 1.3.B in front of the aft port transition point 1.5.B.

In an embodiment of the invention, the extent in the longitudinal direction of the hull for the starboard, and respectively the port, discontinuous transition 1.0.S, 1.0.B may be less than or equal to 0.20 of a construction waterline CWL.

In another embodiment of the invention, the extent in the longitudinal direction of the hull for the starboard, and respectively the port, discontinuous transition 1.0.S, 1.0.B may be less than or equal to 0.15 of a construction waterline CWL.

In another embodiment of the invention, the extent in the longitudinal direction of the hull for the starboard, and respectively the port, discontinuous transition 1.0.S, 1.0.B may be less than or equal to 0.10 of a construction waterline CWL.

In one embodiment of the invention, the transverse starboard keel step 4.0.S and the transverse port keel step 4.0.B may have a step height that is less than or equal to 0.15 of a construction waterline CWL.

In another embodiment of the invention, the transverse starboard keel step 4.0.S and the transverse port keel step 4.0.B may have a step height that is less than or equal to 0.10 of a construction waterline CWL.

In another embodiment of the invention, the transverse starboard keel step 4.0.S and the transverse port keel step 4.0.B have a step height that is less than or equal to 0.05 of a construction waterline CWL.

In an embodiment of the invention, the starboard discontinuous transition 1.0.S may comprise a starboard step profile line 8.0.S with its starboard step secant 8.1.S between an aft step point x_S, where the starboard step profile line 8.0.S runs into the starboard keel line KL.S, and a forward step point x_S+l_S, where the starboard step

profile line 8.0.S crosses the bow base line BBL, and in which a starboard secant angle αS, which is an acute angle between the starboard step edge 8.1.S and the starboard keel line KL.S, is greater than or equal to 1 degree and less than or equal to 30 degrees, and where the port discontinuous transition 1.0.B comprises a port step profile line 8.0.B with its port step secant 8.1.B between an aft step point x_B, where the port step profile line 8.0.B runs into the port keel line KL.B, and a forward step point x_B+l_B, where the port step profile line 8.0.B crosses the bow base line BBL, and in which a port secant angle αB, which is an acute angle between the port step secant edge 8.1.B and the port keel line KL.B, can be greater than or equal to 1 degree and less than or equal to 30 degrees, see especially figure 11.

In an embodiment of the invention, the starboard discontinuous transition 1.0.S can comprise a starboard step profile line 8.0.S with its starboard step secant 8.1.S between an aft step point xS, where the starboard step profile line 8.0.S runs into the starboard keel line KL.S, and a forward step point xS+lS, where the starboard step profile line 8.0.S crosses the bow base line BBL, and in which a starboard secant angle αS, which is an acute angle between the starboard step edge 8.1.S and the starboard keel line KL.S, is greater than or equal to 1 degree and less than or equal to 20 degrees, and where the port discontinuous transition 1.0.B comprises a port step profile line 8.0.B with its port step secant 8.1.B between an aft step point x_B, where the port step profile line 8.0.B runs into the port keel line KL.B, and a forward step point x_B+l_B, where the port step profile line 8.0.B crosses the bow base line BBL, and in which a port secant angle α_B, which is an acute angle between the port step secant edge 8.1.B and the port keel line KL.B, can be greater than or equal to 1 degree and less than or equal to 20 degrees, see in particular figure 11.

In an embodiment of the invention, the starboard discontinuous transition 1.0.S may comprise a starboard step profile line 8.0.S with its starboard step secant 8.1.S between an aft step point xS, where the starboard step profile line 8.0.S runs into the starboard keel line KL.S, and a forward step point x_S+l_S, where the starboard step profile line 8.0.S crosses the bow base line BBL, and in which a starboard secant angle α_S, which is an acute angle between the starboard step edge 8.1.S and the

starboard keel line KL.S, is greater than or equal to 1 degree and less than or equal to 15 degrees, and where the port discontinuous transition 1.0.B comprises a port step profile line 8.0.B with its port step secant 8.1.B between an aft step point xB, where the port step profile line 8.0.B runs into the port keel line KL.B, and a forward step point x_B+l_B, where the port step profile line 8.0.B crosses the bow base line BBL, and in which a port secant angle αB, which is an acute angle between the port step secant edge 8.1.B and the port keel line KL.B, can be greater than or equal to 1 degree and less than or equal to 15 degrees, see especially figure 11.

Detailed description of figures

Figures 0-11 show one or more embodiments of a hovercraft according to the present invention.

In Figure 0 there is a profile only illustrated, elevation, which shows a longitudinal section of an embodiment of the basically V-shaped hull 0.0, which is the same hull as shown in Figure 1a, where the surfaces are now tinted with a gray color , so that the V-shaped bow 3.0 comes forward, both of these Figures shown are seen from the outside towards the starboard side of the hull.

Figure 1b shows an embodiment of the basically V-shaped hull 0.0 with a more general elevation of the longitudinal section, which can either be viewed towards the starboard or port side, as the basically V-shaped hull 0.0 is symmetrical about the centerline CL . Details such as starboard or port, the keel part 2.1.S, 2.1.B, the V-shaped bow 3.0, the bow base line BBL, starboard or port, the keel line KL.S, KL.B, starboard or port, are marked on the figure. discontinuous transition 1.0.S, 1.0.B, the construction waterline KVL, the aft starboard, or port, transition point 1.5.S, 1.5.B, the forward starboard or port point 1.3.S, 1.3.B and the V-shaped bow section in KVL 3.4, to illustrate where they are located on the basically V-shaped hull 0.0.

Figure 2a shows an embodiment of the profile of the bottom of an embodiment of the basically V-shaped hull 0.0 and where an embodiment of the recess in the basically V-shaped hull 0.0 is also shown, which in turn forms the air supported chamber 5.0

and where we see the air supported chamber ceiling 5.1. The figure also shows that the initially V-shaped hull 0.0 seen against the bottom in gray tones so that the contours of the hull come out more clearly.

Figure 2b shows an embodiment of a sketch/drawing of the bottom of an embodiment of the basically V-shaped hull 0.0, where the basically V-shaped hull 0.0 is marked with lines and reference numbers to name the parts of the basically V-shaped hull 0.0. It appears from the Figure that the keel parts, respectively on the starboard and port side, 2.3.S, 2.3.B, extend from the transom 7.2 up to the V-shaped bow 3.0. At the transom 7.2 and between the starboard and port keel parts 2.3.S, 2.3.B there is a closing device 7.0 with a stern threshold 7.1. Furthermore, the Figure shows the air supported chamber 5.0 with the air supported chamber ceiling 5.1 and the air supported chamber side walls, respectively on the starboard and port side, 5.2.S, 5.2.B. It is further shown that the air supported chamber side walls 5.2.S, 5.2.B each comprise a longitudinal keel step, on the starboard and port side respectively, 2.2.S, 2.2.B, and where the edge from the air supported chamber side walls 5.2.S, 5.2.B over to the keel parts 2.1 .S, 2.1.B are respectively starboard and port longitudinal keel rise threshold 2.3.S, 2.3.B. The figure further shows the front part of the bottom of the basically V-shaped hull 0.0 where there is an air intake 5.3, and that the V-shaped bow 3.0 also has the air supported chamber ceiling 5.1 and the air supported chamber side wall bow 5.4. It is further shown that the air supported chamber's side wall bow 5.4 comprises bow step 3.1 with a lower edge as defined as bow step 3.1. Incidentally, a center line CL is also shown, which divides the hull symmetrically into two parts, a starboard and a port part. The bow and stern are not defined as starboard and port.

Figures 3a and 3b show an embodiment of the profile of a cross-section of the middle, a midships section, of the basically V-shaped hull 0.0 seen aft towards the transom 7.2. Figure 3a is in shades of gray which gives a better visual illustration of the curvature of the keel parts, respectively on the starboard side and port side, 2.1.S. 2.1.B, while Figure 3b is a profile view/sketch. The figures show the partly or completely outward sloping air supported chamber side walls 5.2.S, 5.2.B and how

the lower part of the air supported chamber side walls 5.2.S, 5.2.B is a longitudinal vertical keel step, on the starboard and port side respectively, 2.2.S, 2.2.B . The figures also show the lower edge of the keel parts 2.1.S, 2.1.B which is also the keel line threshold, on the starboard and port side respectively, 2.3.S, 2.3.B and which is also in this figure the keel line, on the starboard and port side respectively, KL.S, KL.B.

Figures 4a and 4b show the profile of a cross-section of the middle, a midships section, of the basically V-shaped hull 0.0 seen forward towards the V-shaped bow 3.0. Figure 4a is in shades of gray which gives a better visual illustration of the curvature of the V-shaped bow section 3.0, while Figure 4b is a profile view/sketch. The figures show the air intake 5.3 at the front and the partly or completely outwardly sloping air supported chamber side wall bow 5.4 and how the lower part of the air supported chamber side wall bow 5.4 is a bow step 3.1. The figures also show the lower edge of the air supported chamber's side wall bow 5.4 here as a bow base line BBL. Figure 4b also shows the difference in the draft between the starboard and port keel lines KL.B, KL.S and the bow base line BBL.

Figure 5 shows a sketch of a section at the longitudinal starboard, or port, keel sill 2.3.S, 2.3.B in an embodiment of the basically V-shaped hull 0.0. The figure shows the keel lines, respectively on the starboard and port side, KL.S/KL.B and the bow base line BBL, as well as the difference between the keel line, on the starboard and port side respectively, and the bow base line BBL, which is a transverse starboard keel step 4.0.S and a transverse port keel step 4.0.B. The figure shows here that the bow base line BBL follows the bow step 3.2, and that the keel lines, on the starboard and port side respectively, KL.S, KL.B follow the longitudinal keel step lines, on the starboard and port side respectively, right up to the decline in the discontinuous transition, on respectively starboard and port side, 1.0.S, 1.0.B. The figure further shows with a dashed line a recess area as the air supported chamber 5.0, and where the front part is the air supported chamber's air intake 5.3 and the aft part is delimited by a closing device 7.0 with an aft threshold 7.1. Two cross-sections are

also marked with arrows, one aft with an A and one forward with a B. The cross-sections appear again in Figure 6.

Figure 6 shows two half cross-sections, one aft A and one forward B taken from Figure 5, of an embodiment of the basically V-shaped hull 0.0. The figure shows a composite cross-section of A and B about the center line CL, as the basically V-shaped hull 0.0 is symmetrical about the center line CL. Cross section A is an embodiment of the air supported chamber's starboard side wall 5.2.S, here slightly sloping outwards, and comprising the starboard longitudinal keel step 2.2.S, here vertical, and with a starboard longitudinal keel step threshold 2.3.S. Cross section B is an embodiment of the side wall of the air supported chamber bow 5.4, here very slightly sloping outwards, and comprising a bow step 3.1 with a bow step threshold 3.2. Furthermore, the Figure shows the starboard keel line KL.S, which here hits the starboard longitudinal keel step 2.3.S, and the bow base line BBL, which here hits the bow threshold 3.2, and the difference between them, also called transverse starboard keel step 4.0.S.

Figure 7 shows an embodiment of frame sections in a port discontinuous transition 1.0.B, also called the discontinuous transition area, seen obliquely from the bow towards the longitudinal port keel part 2.1.B. The figure shows the recess area for the air supported chamber 5 with air supported chamber ceiling 5.1 which extends to the air supported chamber's port side wall 5.2.B, here shown slightly sloping outwards. In the discontinuous transition 1.0.B as shown in Figure 7, there are both bow steps 3.1 and port longitudinal keel steps 2.2.B which are decreasing 1.1.B. The figure also shows how the frames in the discontinuous transition from the V-shaped bow to the port longitudinal keel part with a port transverse step 4.0.B. It is also apparent from the figure that the straight phasing of the longitudinal port keel part 2.2.B. The hull is symmetrical and has a corresponding starboard design.

Figures 8a and 8b show an embodiment of frame sections in a port discontinuous transition 1.0.B, also called the discontinuous transition area, seen obliquely from above from the bow towards the port longitudinal keel part 2.1.B. The hull is

symmetrical and has a corresponding starboard design. The figures show the recess area for the air supported chamber 5 with air supported chamber ceiling 5.1 which extends to the air supported chamber's port side wall 5.2.B, here shown slightly sloping outwards. Figure 8a shows forward port point 1.3.B, which is the forward termination of port discontinuous transition 1.0.B or termination point for port keel part, and aft port transition point 1.5.B, which is the aft termination of port discontinuous transition 1.0.B (the transition point). From the forward port point 1.3.B and to the aft port transition point 1.5.B, lies, among other things, as shown in Figures 8a and 8b:

- Decreasing port keel step 1.1.B
- outwardly sloping port keel surface 1.2.B
- Aft part of port bow step 1.4.B
- Backwards tapering port outphasing part 1.6.B

Figure 8b shows how these geometric surfaces of the decreasing port keel step 1.1.B, the outward sloping port keel surface 1.2.B, the aft part of the port bow step 1.4.B and the backward tapering port phasing part 1.6.B are fitted together with relatively sharp angles, which fit well together when making hulls in aluminium, steel or other weldable materials, but can also be cast in carbon, plastic or fiberglass. Such a design as shown in Figures 8a and 8b will also help to reinforce, stiffen, the hull in the discontinuous transition 1.0.B.

Figures 9a and 9b show an embodiment of frame sections in a port discontinuous transition 1.0.B, also called the discontinuous transition area, seen from the center line and directly towards the forward part of the port longitudinal keel part 2.1.B. The hull is symmetrical and has a corresponding starboard design. The figures show the port discontinuous transition 1.0.B from an aft port transition point 1.5.B to a forward port point 1.3.B and where you have a port longitudinal keel step 2.2.B on the frame at the aft port transition point 1.5.B and where you have a bow step 3.1 on the frame at the forward port point 1.3.B. In between these points, the forward port point 1.3.B and to the aft port transition point 1.5.B, there is a decreasing port keel step 1.1.B, which extends from the aft port transition point 1.5.B and straight forward and up outside its aft part of the port bow step 1.4.B and ends in the forward port point 1.3.B

in the outer bow bearing surface 3.3. The figures also show how the aft part of the port bow step 1.4.B has a constant height/draft through the port discontinuous transition 1.0.B before it is joined with the port longitudinal keel step 2.2.B in the aft port transition point 1.5.B. The figures also show that the port keel line KL.B does not follow the port longitudinal keel step 2.2.B after the aft port transition point 1.5.B and that there is a vertical step up to the bow base line BBL from the port keel line KL.B.

Figure 10 shows an embodiment of frame sections in a port discontinuous transition 1.0.B, also called the discontinuous transition area, seen from above straight down towards the forward part of the port longitudinal keel part 2.1.B. The figure shows the frames in the air supported chamber ceiling 5.1 which extend towards the air supported chamber's port side wall 5.2.B, which is slightly sloping outwards. The figure also shows the outwardly sloping port keel surface 1.2.B and the backwards tapering port phasing part 1.6.B, as these geometric parts have a horizontal design. The figure does not show the decreasing port keel step 1.1.B nor the aft part of the port bow step 1.4.B, as these geometric parts have a vertical design. The figure only shows the lines of the decreasing port keel step 1.1.B and the aft part of the port bow step 1.4.B, which are marked with thick black lines on the figure. It is clear from the Figure a straight decreasing port keel step 1.1.B until it joins the outer bow bearing surface 3.3 and how the aft part of the port bow step 1.4.B curves in and transitions to become bow step 3.1 in the V-shaped bow 3.0.

Figure 11 shows an embodiment of the frame sections in the discontinuous transition 1.0.B in a plan sketch, seen from the center line CL towards the port side, and where a port step profile line 8.0.B with a port step secant 8.1.B, which is marked with a highlighted line , extends from an aft step point xB and a forward step point $x_B + l_B$, where the aft point xB is defined as the point where the port step profile line coincides with the port keel line KL.B and where the forward point $x_B + l_B$ is defined as the point where the step profile line crosses the bow baseline BBL. The step profile line is defined as the hull line of the port keel step threshold on the decreasing port keel step 1.1.B between the points x_B and $x_B + l_B$.

The figure shows a definition of xy-coordinates, where the y-axis is defined as a function of x and the x-axis is the longitudinal direction of the hull. The average growth rate (here: the rise) between xB and xB + lB can thus be expressed mathematically as:

$$\frac{\Delta y}{\Delta x} = \frac{f(x_B + l_B) - f(x_B)}{l_B}$$

The derivative of the function f(x), i.e. f'(x), can be expressed as lB goes towards zero, then the secant approaches the tangent, because (xB + lB, f(xB + lB)) gets closer and closer to (xB , f(xB)). The gradient of the tangent becomes the gradient of the secant when l_B approaches zero:

$$\lim_{l_B \to 0} \frac{\Delta y}{\Delta x} = \frac{f(x_B + l_B) - f(x_B)}{l_B}$$

The figure shows that the port side riser edge 8.1.B forms a secant angle αB, which is an acute angle with the port keel line KL.B, where the secant angle αB shows the pitch of the port side riser edge 8.1.B between the points xB and xB + lB. The port sidestep profile line 8.0.B can be curved, curved or similar, and need not in itself have a constant pitch between a rear step point xB and a forward step point $x_B + l_B$. The port sidestep 8.1.B can therefore be used to define the relationship between the length and height of the port transverse step 4.0.B in the form of the secant angle α_B.

Further explanation to Figure 11 for the discontinuous transition:
x_B: is defined as the point where the profile line coincides with the keel line.
x_B+l_B: is defined as the point where the profile line crosses the bow base line.
Profile line: the hull line here defined between points x_B and $x_B + l_B$.
$f(x_B)$: function of x_B in the y direction.
$f(x_B+l_B)$: function of x_B+l_B in the y direction.

The secant: a straight line which cuts through the profile line in at least two points and which here is delimited in the x direction by a length l, which is the distance between x_B and $x_B + l_B$.

The rise of the secant may be written as, and is the average growth rate between x_B and $x_B + l_B$:

$$\frac{\Delta y}{\Delta x} = \frac{f(x_B + l_B) - f(x_B)}{l_B}$$

The derivative of the function f(x), i.e. f'(x), can be expressed as l approaches zero, then the secant approaches the tangent, because ($x_B + l_B$, $f(x_B + l_B)$) gets closer and closer to (xB , f(xB)). The gradient of the tangent becomes the gradient of the secant as l approaches zero:

$$\lim_{l_B \to 0} \frac{\Delta y}{\Delta x} = \frac{f(x_B + l_B) - f(x_B)}{l_B}$$

Reference table:

Reference	Name	Description
CL	Center line	Center line
KVL	Construction waterline	Waterline for a fully loaded vessel
SB	Starboard	Starboard
BB	Port side	Port side
KL.S	Starboard keel line	Line that substantially follows the starboard longitudinal keel step (2.3.S) forward until the port longitudinal keel threshold (2.2.S) decreases
KL.B	Port keel line	Line that mainly follows the port longitudinal keel threshold (2.3.B) forward until the port longitudinal keel threshold (2.2.B) decreases
BBL	bow baseline	Line that mainly follows the bow step (3.2)
0.0	V-shaped hull	Cf. Basically V-shaped hull
1.0.S	Starboard discontinuous transition	Transition or transition area.
1.0.B	Port discontinuous transition	Transition or transition area.
1.1.S	Decreasing starboard keel step	In the discontinuous starboard transition area (1.0.S)
1.1.B	Decreasing port keel step	In the discontinuous port transition area (1.0.B)
1.2.S	Outwardly sloping starboard keel surface	In the starboard discontinuous transition area (1.0.S)
1.2.B	Outwardly sloping port keel surface	In the discontinuous port transition area (1.0.B)
1.3.S	Foremost starboard point	The foremost termination of the starboard discontinuous

		transition / termination point of the starboard keel
1.3.B	Foremost port point	The foremost termination of the port discontinuous area / termination point of the port keel
1.4.S	Aft part on starboard bow step	Bow step on starboard side in the discontinuous transition area
1.4.B	Aft part of port bow step	Bow step on the port side in the discontinuous transition area
1.5.S	Aft starboard transition point	The aft end of the starboard discontinuous transition (the transition point)
1.5.B	Aft port transition point	The aft termination of the port discontinuous transition (transition point)
1.6.S	Rearward tapering starboard phase-out section	Phase-out of the outer bow bearing surface (3.3) in the starboard discontinuous transition (1.0.S)
1.6.B	Rearward tapering port phase-out section	Phase-out of the outer bow bearing surface (3.3) in the port discontinuous transition (1.0.B)
2.0	V-shaped keel part	
2.1.S	Starboard keel part	
2.1.B	Port keel part	
2.2.S	Starboard longitudinal keel step	
2.2.B	Port longitudinal keel step	
2.3.S	Starboard longitudinal keel step threshold	
2.3.B	Port longitudinal keel step threshold	
3.0	V-shaped bow section	

3.1	Bow step	Extends from starboard to port keel step
3.2	Bow step threshold	Bow step threshold is the transition from the bow step to the keel in the bow
3.3	Outer bow bearing surface	The surface (skin) of the hull outside the bow sill in the bow
3.4	V-shaped bow section in construction water line (CWL)	
4.0.S	Transverse starboard keel step	The difference between starboard keel line (KL.S) and bow base line (BBL).
4.0.B	Transverse port keel step	The difference between port keel line (KL.B) and bow base line (BBL).
5.0	Air supported chamber	The area on the underside of the hull intended to be filled with air.
5.1	Air supported chamber ceiling	
5.2.S	Starboard side wall of the air supported chamber	
5.2.B	Air supported chamber's port side wall	
5.3	Air supported chamber air intake	
5.4	Air supported chamber’s sidewall bow	
7.0	Closing device	
7.1	Aft threshold	
7.2	Stern	
8.0.S	Starboard step profile line	A hull line of the keel step threshold on the decreasing starboard keel step 1.1.S

		between points x0 and x0 + l on the starboard side.
8.0.B	Port step profile line	A hull line of the keel step threshold on the decreasing port keel step 1.1.B between points x_B and $x_B + l_B$ on the starboard side.
8.1.S	Starboard step secant	A straight line, like a secant, which cuts through the starboard profile line in at least two points, and which here is delimited in the x direction by a length ls, which is the distance between xs and $x_s + l_s$.
8.1.B	Port sidestep secant	A straight line, like a secant, which cuts through the port profile line in at least two points, and which here is delimited in the x direction by a length lB, which is the distance between x_B and $x_B + l_B$.
x_s	Aft starboard step point	Is defined as the point where the starboard profile line 8.0.S runs into the starboard keel line KL.S.
$x_s + l_s$	Forward starboard step point	Is defined as the point where the starboard profile line 8.0.S crosses the bow base line BBL.
x_B	Aft port step point	Is defined as the point where the port profile line 8.0.B runs into the port keel line KL.B.
$x_B + l_B$	Front port step point	Is defined as the point where the port profile line 8.0.B crosses the

		bow base line BBL.
l_S	Starboard step length.	A length between xS and xS+lS along an x-axis.
l_B	Port step length	A length between x_B and x_B+l_B along an x-axis.
α_S	Starboard secant angle	Is defined as an acute angle between the starboard secant 8.1.S and the starboard keel line KL.S.
α_B	Port secant angle	Is defined as an acute angle between the port secant 8.1.B and the port keel line KL.B.

CLAIMS

1. An air supported vessel comprising the following features,
- a V-shaped hull (0.0)
- with a starboard keel part (2.1.S) and a port keel part (2.1.B), and
- with a V-shaped bow (3.0), comprising an outer bow bearing surface (3.3),
- where the V-shaped hull (0.0) has at least one air supported chamber (5.0) in a part of the V-shaped hull's (0.0) length below a waterline,
- the air supported chamber (5.0) is delimited by an air supported chamber ceiling (5.1), air supported chamber starboard and port side walls (5.2.S, 5.2.B) and with at least one aft closing device (7.0) with aft threshold (7.1) which forms an aft boundary of the air supported chamber (5.0) and with at least one air support chamber air intake (5.3) which together with the side wall of the air supported chamber in the bow (5.4) form a front boundary of the air supported chamber (5.0),
wherein the V-shaped bow (3.0) further comprises a bow step (3.1) with a bow step threshold (3.2), which extends from a starboard longitudinal keel step (2.2.S) around the V-shaped bow (3.0) to a port longitudinal keel step (2.2.B), and forms a lower boundary of the air supported chamber sidewall in the bow (5.4), to reduce air leakage below a bow base line (BBL),
c h a r a c t e r i s e d by
- a transverse step at an aft part of the bow base line (BBL), comprising a starboard transverse step (4.0.S) and a port transverse step (4.0.B), where the starboard keel part (2.1.S) with a starboard keel line (KL.S) and the port keel part (2.1.B) a the port keel line (KL.B) have greater draft than the V-shaped bow (3.0) with the bow base line (BBL) at the starboard transverse step (4.0.S) and the port transverse step (4.0.B).

2. The air supported vessel according to claim 1, wherein
- the starboard keel part (2.1.S), comprises the starboard longitudinal keel step (2.2.S) and a starboard keel step threshold (2.3.S), which form a lower starboard

lateral delimitation of the air support chamber's starboard side wall (5.2.S), to reduce air leakage under a starboard keel line (KL.S), and

- the port keel part (2.1.B), comprises the port longitudinal keel step (2.2.B) and a port keel step threshold (2.3.B), which forms a lower port side boundary of the air supported chamber's port side wall (5.2.B), to reduce air leakage under a port keel line (KL.B).

3. The air supported vessel according to claim 1, wherein

- a transition between the starboard longitudinal keel step (2.2.S) and the starboard aft part of the bow step (1.4.S) is a starboard discontinuous transition (1.0.S), and in which

- a transition between the port longitudinal keel step (2.2.B) and the port aft part of the bow step (1.4.B) is a port discontinuous transition (1.0.B).

4. The air supported vessel according to claim 3, wherein the starboard discontinuous transition (1.0.S) extends from a forward starboard point (1.3.S) on the starboard keel where the starboard longitudinal keel step (2.2.S) runs into the outer bow bearing surface (3.3) on the starboard side on the outside of the bow step (3.1), and aft to an aft starboard transition point (1.5.S) on the starboard keel where the bow step (3.1) runs into the starboard longitudinal keel step (2.2.S), and

in which the port discontinuous transition (1.0.B) extends from a forward port point (1.3.B) on the port keel where the port longitudinal keel step (2.2.B) runs into the outer bow bearing surface (3.3) on the port side on the outside of the bow step (3.1), and aft to an aft port transition point (1.5.B) on the port keel, where the bow step (3.1) on the port side runs into the port longitudinal keel step (2.2.B).

5. The air supported vessel according to claim 3, wherein the discontinuous transition, on the starboard and port side respectively (1.0.S, 1.0.B), forms a straight line forward and which extends up and converges in the outer bow bearing surface (3.3) on the starboard side respectively and port side of the V-shaped bow (3.0).

6. The air supported vessel according to claim 3 or 4, wherein the starboard discontinuous transition (1.0.S) comprises:
- a decreasing starboard keel step (1.1.S) in the forward direction, and
- an outward inclining starboard keel surface (1.2.S), and
- an aft part of the starboard bow step (1.4.S), and
- a backward tapering starboard outphasing part (1.6.S) of the outer bow bearing surface (3.3), on the starboard side, between the decreasing starboard keel step (1.1.S) and the aft part of the starboard bow step (1.4.S), and in which the port discontinuous transition (1.0.B) includes:
- a decreasing port keel step (1.1.B) in the forward direction, and
- an outward inclining port keel surface (1.2.B), and
- an aft part of the port bow step (1.4.B), and
- a backward tapering port outphasing part (1.6.B) of the outer bow bearing surface (3.3), on the port side, between the decreasing port keel step (1.1.B) and the aft part of the port bow step (1.4.B).

7. The air supported vessel according to claim 3, 4, 5 or 6, wherein the starboard discontinuous transition (1.0.S) comprises:
- that the transverse starboard step (4.0.S), which is the difference between a design draft at the aft starboard transition point (1.5.S) and a design draft at the forward starboard point (1.3.S), and in which the port discontinuous transition (1.0. B) includes:
- that the transverse port step (4.0.B) is the difference between a design draft at the aft port transition point (1.5.B) and a design draft at the forward port point (1.3.B).

8. The air supported vessel according to claim 1 or 2, wherein the V-shaped bow (3.0) has a bow base line (BBL) with a slight dip forward calculated from a transition between the bow step (3.1) and the starboard longitudinal keel step (2.2.S) or the port longitudinal keel step (2.2.B).

9. The air supported vessel according to claim 1 or 2, wherein the V-shaped bow (3.0) has a bow base line (BBL) which is substantially horizontal from a transition

between the bow step (3.1) and respectively the starboard longitudinal keel step (2.2.S) or the port longitudinal keel step (2.2.B).

10. The air supported vessel according to claim 1, wherein the starboard keel part (2.1.S) is parallel, from the at least one aft closure device (7.0) forward to a forward starboard point (1.3.S), with the V-shaped hull's (0.0) center line (CL) and in which the port keel part (2.1.B) is parallel, from the at least one aft closing device (7.0) forward to a port forward point (1.3.B), with the V- shaped hull's (0.0) center line (CL).

11. The air supported vessel according to claim 1, wherein the aft threshold (7.1) has an adjustable draft.

12. The air supported vessel according to claim 1, wherein the air supported chamber side walls, respectively on the starboard and port side, (5.2.S, 5.2.B), are entirely or partially, outwardly inclined.

13. The air supported vessel according to claim 1, wherein the longitudinal keel steps, on the starboard and port side respectively (2.2.S, 2.2.B), are substantially vertical steps.

14. The air supported vessel according to claim 2, wherein the bow step (3.1) is a vertical step.

15. The air supported vessel according to claim 1, wherein the V-shaped bow (3.0), comprising a bow step (3.1), which extends aft to the aft starboard, and respectively the aft port, transition point (1.5.S, 1.5.B) located near the center (0.5 x CWL) of a construction water line (CWL).

16. The air supported vessel according to claim 4, wherein the starboard longitudinal keel step (2.2.S) extends forward to the forward starboard point (1.3.S) in front of the aft starboard transition point (1.5.S), and in which the port longitudinal keel step (2.2.

B) extends forward to the forward port point (1.3.B) in front of the aft port transition point (1.5.B).

17. The air supported vessel according to claim 3, 4, 5, 6 or 7, wherein
- the starboard discontinuous transition (1.0.S) includes a starboard step profile line (8.0.S) with its starboard step secant (8.1.S) between an aft step point (x_S), where the starboard step profile line (8.0.S) runs into the starboard keel line (KL.S), and a forward step point (x_S+l_S), where the starboard step profile line (8.0.S) intersects the bow base line (BBL), and in which a starboard secant angle (α_S), which is an acute angle between the starboard step secant (8.1.S) and the starboard keel line (KL.S), is greater than or equal to 1 degree and less than or equal to 30 degrees, and in which
- the port discontinuous transition (1.0.B) includes a port step profile line (8.0.B) with its port step secant (8.1.B) between an aft step point (x_B), where the port step profile line (8.0.B) runs into the port keel line (KL.B), and a forward step point (x_B+l_B), where the port step profile line (8.0.B) intersects the bow base line (BBL), and in which a port secant angle (α_B), which is an acute angle between the port step secant (8.1.B) and the port keel line (KL.B), is greater than or equal to 1 degree and less than or equal to 30 degrees.

18. The air supported vessel according to claim 3, 4, 5, 6 or 7, wherein
- the starboard discontinuous transition (1.0.S) includes a starboard step profile line (8.0.S) with its starboard step secant (8.1.S) between an aft step point (x_S), where the starboard step profile line (8.0.S) runs into the starboard keel line (KL.S), and a forward step point (x_S+l_S), where the starboard step profile line (8.0.S) intersects the bow base line (BBL), and in which a starboard secant angle (α_S), which is an acute angle between the starboard step secant (8.1.S) and the starboard keel line (KL.S), is greater than or equal to 1 degree and less than or equal to 20 degrees, and in which
- the port discontinuous transition (1.0.B) includes a port step profile line (8.0.B) with its port step secant (8.1.B) between an aft step point (x_B), where the port step profile line (8.0.B) runs into the port keel line (KL.B), and a forward step point (x_B+l_B), where

the port step profile line (8.0.B) intersects the bow base line (BBL), and in which a port secant angle (α_B), which is an acute angle between the port step secant (8.1.B) and the port keel line (KL.B), is greater than or equal to 1 degree and less than or equal to 20 degrees.

19. The air supported vessel according to claim 3, 4, 5, 6 or 7, wherein
- the starboard discontinuous transition (1.0.S) includes a starboard step profile line (8.0.S) with its starboard step secant (8.1.S) between an aft step point (x_S), where the starboard step profile line (8.0.S) runs into the starboard keel line (KL.S), and a forward step point (x_S+l_S), where the starboard step profile line (8.0.S) intersects the bow base line (BBL), and in which a starboard secant angle (α_S), which is an acute angle between the starboard step secant (8.1.S) and the starboard keel line (KL.S), is greater than or equal to 1 degree and less than or equal to 15 degrees, and in which
- the port discontinuous transition (1.0.B) includes a port step profile line (8.0.B) with its port step secant (8.1.B) between an aft step point (x_B), where the port step profile line (8.0.B) runs into the port keel line (KL.B), and a forward step point (x_B+l_B), where the port step profile line (8.0.B) intersects the bow base line (BBL), and in which a port secant angle (α_B), which is an acute angle between the port step secant (8.1.B) and the port keel line (KL.B), is greater than or equal to 1 degree and less than or equal to 15 degrees.