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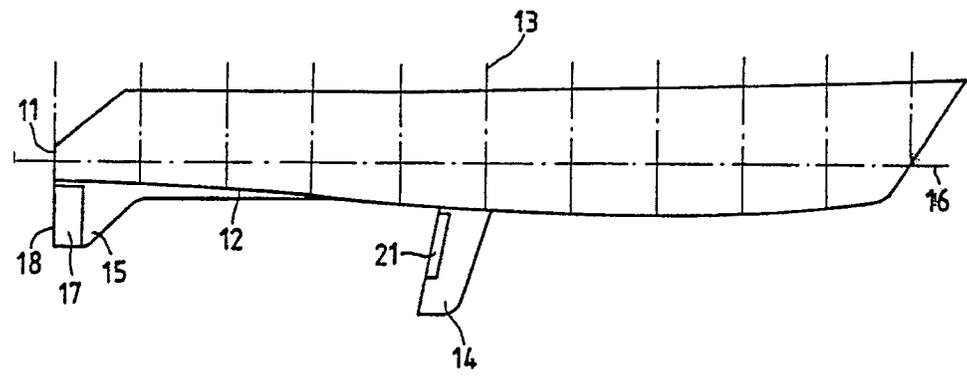
Underbody for fast sailing-boats.

An underbody for sailing-boats endowed With fast speed characteristics has its bottom portion, abaft the midship section, of either straight or convex-arcuate shape, with a convexity of not more than 0.004% of the hull length at waterline level; said underbody has a generatrix not longer than 35% of the hull length at waterline level; the transom is submerged and the immersion depth thereof is of not more than 16% of the width of the same transom at its waterline level, and furthermore three hull appendices (i.e., a skeg and two keels) are provided, which protruding downwards under the boat hull.

A first appendix (i.e., the skeg) is on the centre line of the hull, and in the nearby of the end portion thereof, and the other two appendices (i.e., two keels) are side-by side to each other, in a non-essentially central region as regards the length of the hull.

In particular, the first underbody appendix shows at least one mobile portion and the two appendices arranged side-by-side to each other have an asymmetrical aerodynamic outline, protruding to a larger extent in the region between them.

Fig.1



EP 0 431 678 A1

"UNDERBODY FOR FAST SAILING-BOATS"

The present invention relates to an underbody for fast sailing-boats.

The underbodies of the sailing-boats known from the prior art have been built heretofore by starting from the assumption that the force which opposes to the movement of a boat, in particular of a sailing-boat, is the friction resistance, strictly related to the underwater portion of the underbody, i.e., of the submerged portion of the hull. This, because in the scientific background the opinion has prevailed always that by reducing the value of the above said friction resistance, the advancement resistance would be reduced and therefore, With the thrust being the same, higher speeds would be reached.

A purpose of the present invention is of providing an underbody for sailing-boats, which is faster than those as known hereofore, and this even subverting the scientific theories used to date in order to design the shapes and the outlines of a sailing-boat.

A further purpose is of providing a fast boat underbody, in particular for boats powered by the only bind thrust, as a component applied to the surface of the sails.

These purposes according to the present invention are accomplished by providing an underbody for fast sailing-boats, characterized in that it has its bottom portion, abaft the midship section, of either straight or convex-arcuate shape, with its convexity being of not more than 0.004% of the hull length at waterline level; in that the underbody has a generatrix not longer than 35% of the hull length at waterline level; in that the transom is submerged and the immersion depth thereof is of not more than 16% of the width of the same transom at its waterline level, and in that three underbody appendices are provided which protrude downwards under the hull: a first appendix arranged on the centre line of the hull, and in the nearby of the end portion thereof, and the other two appendices arranged side-by side to each other, with an aspect value of not less than 2.5, installed in a non-essentially central region relatively to the length of the hull.

Preferably, the first underbody appendix shows at least one mobile portion.

Advantageously, the two appendices arranged side-by-side to each other have an asymmetrical aerodynamic outline, protruding to a larger extent in the underbody region lying between them.

The structural and functional characteristics and the advantages of an underbody for sailing-boats according to the present invention will be better understood from the following exemplifying,

non-limitative disclosure thereof, referred to the hereto attached schematic drawings, in which:

Figure 1 is a schematic elevation view, i.e., a profile view, of a sailing-boat underbody according to the present invention;

Figure 2 shows an enlarged detail of Figure 1, showing the outline of the lower portion of the sailing-boat underbody abaft the midship section, and of the submerged transom;

Figure 3 shows a diagram relevant to characteristics of the bottom portion and of the transom of the boat's underbody,

Figure 4 shows a magnified detail of Figure 1, showing the first skeg and the mobile element thereof (flap or rudder);

Figure 5 shows a sectional view according to the path line V-V of Figure 4;

Figure 6 shows a front view, showing, essentially magnified, two ballast-keels of the boat's underbody of Figure 1;

Figure 7 shows a magnified side view of one single ballast-keel; and

Figure 8 shows a plan view of the ballast-keel of Figure 7.

Referring to the figures, an underbody for sailing-boats according to the present invention has been developed on the basis of a nondimensional formula which correlates the length of a hull at its waterline level, which is commonly indicated as "L.W.L.", with the speed, indicated as "V", and expressed as knots.

This expression, which is said "relative speed" or "Froude's number", and is represented for the sailing-boats according to the prior art by the expression V/\sqrt{L} , wherein the value of "V" is expressed as knots, and the value of L.W.L. is expressed as feet, has never been higher than 1.4-1.5.

Furthermore, according to the instant invention, the present Applicant aimed, contrarily to what was thought heretofore as regards the need of reducing the wet surface-area of the submerged portion of boat's underbody and the friction resistance, at eliminating, or at least reducing, the wave resistance, so as to nearly double the above shown value, up to reach new values of from 2.5 to 3.5.

The main characteristics of the so designed sailing-boats underbody according to the present invention can be briefly summarized by referring to the above listed drawings.

Perhaps, it results necessary to premise some indications relevant to the terms used in the following, in order to facilitate the understanding of the inventive features of the sailing-boat underbody according to the present invention.

By referring to Figure 1, With the reference numeral 11 the transom is indicated, with the reference numeral 12 the outline of the bottom portion of the boat's underbody is indicated, with the reference numeral 13 the midship section is indicated, with the reference numerals 14 and respectively 15 the underbody appendices are indicated, which protrude downwards under the hull.

Furthermore, in Figure 2 with the reference numeral 26 portions of boat's hull are indicated, which correspond to one tenth of L.W.L. (line water line), i.e., of the length of the hull 16 at waterline level.

In Figure 3, in which the characteristics of the bottom portion and of the transom of the boat's underbody are schematically shown, with the following symbols the following elements are indicated: with "Gc", the boat's underbody generatrix; with "L", the width of the boat's underbody at the transom at the waterline level L.W.L.; with "Is", the immersion depth of the transom. It can be furthermore observed that a plurality of submerged sections from the transom to the midship section are shown, which are derived from the submerged depth of the same sections, connected with the point "Gc" by the centre line on the waterline plane. Furthermore, "IsM" indicates the submerged depth at midship section.

In Figure 4 and in Figure 5, the first boat's underbody appendix, or "underbody skeg", 15 and the shape of its section are shown in greater detail.

Finally, Figures 6, 7 and 8 show in greater detail the features relevant to the pair of boat's underbody appendices or keels 14, the shapes of their sections and the presence of mobile portions. In these drawings, by the symbol "X" the length of one of said keels in the nearby of the boat's underbody outline is shown, by the symbol "Y" the length of one of said keels in the nearby of its free end is shown, and by the symbol "H" the height of said keel is indicated.

According to the present invention, an underbody for sailing-boats should have a shape of its bottom outline abaft the middleship section 13, which can be straight, as shown in chain line in Figure 2, but which is preferably arcuate, as shown in same Figure in solid line. The convexity of such an outline should be either equal to, and/or not higher than 0.004% of the length of the boat hull at its waterline level L.W.L..

Furthermore, the characteristics are conclusive of the bottom of the underbody and of the transom, as shown in Figure 3. In fact, the boat's underbody should have an underbody generatrix Gc not longer than 35% of L.W.L. length, with the following equation being complied with:

$$Gc = (L.W.L. \times 35)/100$$

Such a value determines the flat and warped

outline of the underbody, and is precisely this one the shape which primarily makes it possible the desired high speeds to be accomplished.

Furthermore, it can be observed that the immersion depth of the transom Is should not be of more than 16% of the width of the same transom at waterline level L according to the following equation:

$$Is = (L \times 16)/100.$$

Coming now to Figures 4 and 5, one can observe that the first boat's underbody appendix or skeg 15, which is entrusted with the boat steering control effect, has such a shape and length which make it possible the rudder effect to be optimized. In fact, a mobile portion 17 can be provided, which is arranged at the rearmost portion of said pin, and makes it possible the water stream flowing along the profile of the same skeg to be diverted, with the corresponding side thrust being consequently achieved. It should be furthermore observed that the outline of the skeg is of symmetrical, biconvex type, such as to generate a lift effect, which adds up to the first component.

It is furthermore very important to observe that the abaft edge of the skeg 15 is truncated, so that the same skeg will have a thicker trailing edge 18. Such a truncated shape, together with the structural unit constituted by the skeg and the mobile portion, will contribute to a higher sensitivity of the boat steering control apparatus, so as to make it possible a rudder effect With a smaller angle to be obtained. As a consequence, a lower advancement resistance and a higher speed of the boat will be achieved, together with a higher route stability.

Figures from 6 to 8 show the two central ballast keels, which are arranged in parallel relatively to the centre line of the boat, are connected with each other, at their bottom portion, by a stabilizer tie-rod 19 and can have their axes 20 either perpendicular and parallel to each other, or outwards divergent at an angle " β ".

Further noteworthy features of these two ballast appendices or keels 14 are their aspect value, and their outline.

The above said Figures exemplify a possible value for said aspect "A" of these keels, which aspect should be not lower than 2.5 times the value given by the ratio of the height "H" to the mean chord "CM" given by the expression

$$CM = (X + Y)/2.$$

The outline of these two keels 14 is of asymmetrical biconvex type, with the back of said keels being arranged towards the centre of the boat, i.e., in the underbody region provided between said two keels.

Also in this case, mobile portions 21 can be

provided, which are essentially positioned in an intermediate region of the keel 14. Said mobile portions will make it possible, under determined circumstances, to increase the lift of the same keels. In that way, the speed performance of the boat can be optimized.

The whole of the above said characteristics, i.e., of the lines of boat's underbody, of the shapes of the underbody appendices and the presence of said underbody appendices constitute the characterizing features which make it possible sailing-boats to be developed which, although can be of any sizes, will all show the common feature of being capable of developing a high relative speed.

In fact, all of them will share, besides their high speed, two extremely important factors which determine the basic value of safety and lift. The safety is supplied by the shape of the bottom of boat's underbody, which tends to develop a component which tends to right the boat, which component precisely derives from the increase in boat speed, i.e., a dynamic stability is reached, which opposes the wind force, which would tend to incline the sailing-boat.

Furthermore, the presence of the windward keel exerts, also thanks to the profile of said keel, an additional lift effect, which contributes to right the boat.

Summing-up, advantageously according to the present invention the two stability components, i.e., the shape stability component and the ballast stability component determine a novel geometry by means of which a boat can be obtained, which is different from, and is faster and safer than, the boats known from the prior art, in particular in the field of sailing-boats.

Claims

1. Underbody for fast sailing-boats, characterized in that it has its bottom portion, abaft the midship section, of either straight or convex-arcuate shape, with its convexity being of not more than 0.004% of the hull length at waterline level; in that the underbody has a generatrix not longer than 35% of hull length at waterline level; in that the transom is submerged and the immersion depth thereof is of not more than 16% of the Width of the same transom at its waterline level, and in that three underbody appendices are provided, which protrude downwards under the hull: a first appendix arranged on the centre line of the hull, and in the nearby of the end portion thereof, and the other two appendices arranged side-by-side to each other, with an aspect value of not less than 2.5, installed in a non-essentially

central region relatively to the length of the hull.

2. Underbody for boats according to claim 1, characterized in that the first underbody appendix shows at least one mobile portion.
3. Underbody for boats according to claim 1, characterized in that the two keels arranged side-by-side to each other have an asymmetrical aerodynamic outline, protruding to a larger extent in the region between them, i.e., towards the centre of the boat.
4. Underbody for boats according to claim 3, characterized in that said two keels arranged side-by-side to each other have a biconvex outline.
5. Underbody for boats according to claim 1, characterized in that between the two keels arranged side-by-side to each other, a stabilizer tie-rod is installed.
6. Underbody for boats according to claim 1, characterized in that said two keels arranged side-by-side to each other have their axes perpendicular to a hypothetical horizontal line.
7. Underbody for boats according to claim 1, characterized in that said two keels arranged side-by-side to each other have their axes diverging outwards at a determined angle " β ".
8. Underbody for boats according to claim 1, characterized in that said two keels arranged side-by-side to each other are provided with mobile portions.
9. Underbody for boats according to claim 1, characterized in that said first, central appendix has a symmetrical outline.
10. Underbody for boats according to claim 9, characterized in that said first appendix (i.e., the skeg) has a biconvex outline.

Fig.1

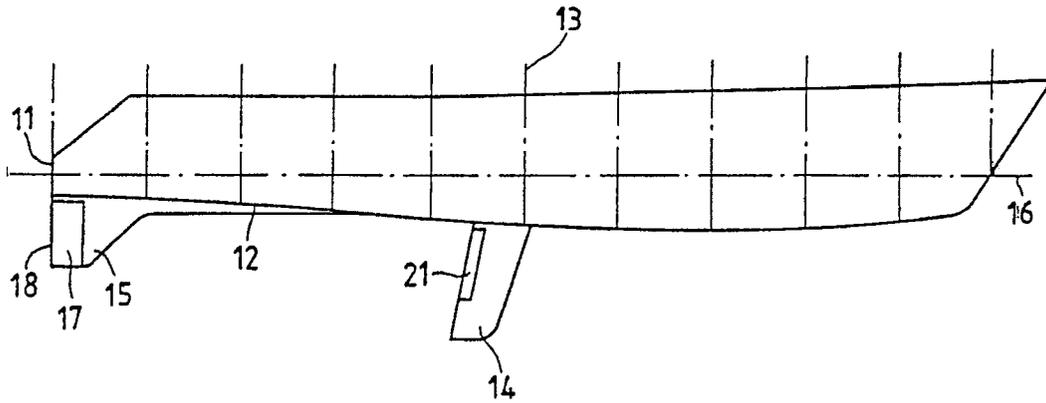


Fig.3

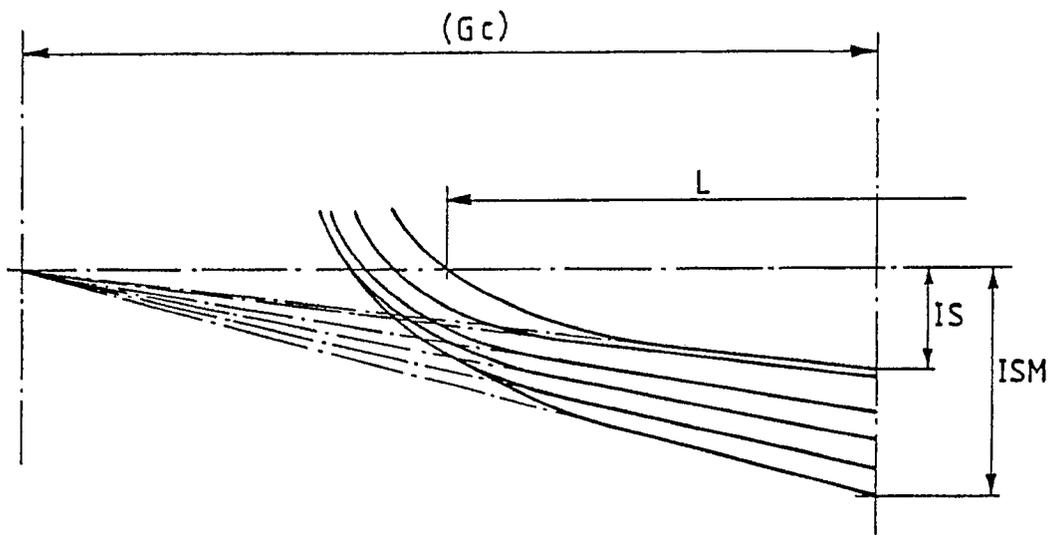


Fig.2

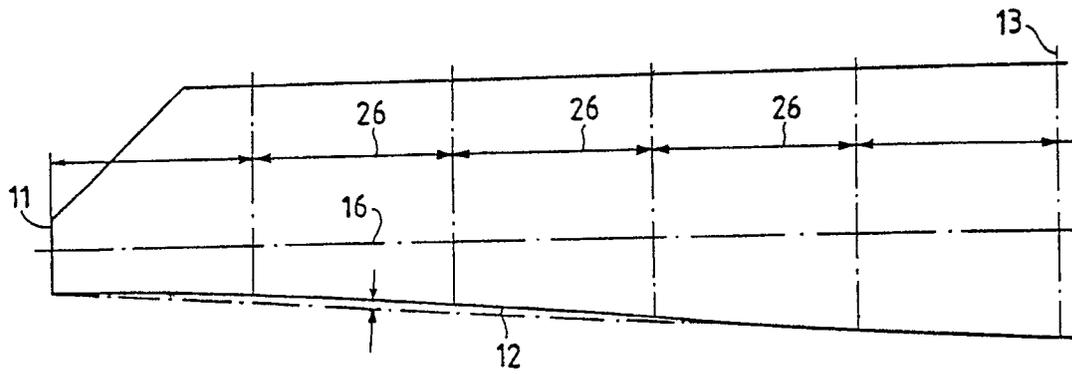


Fig.4

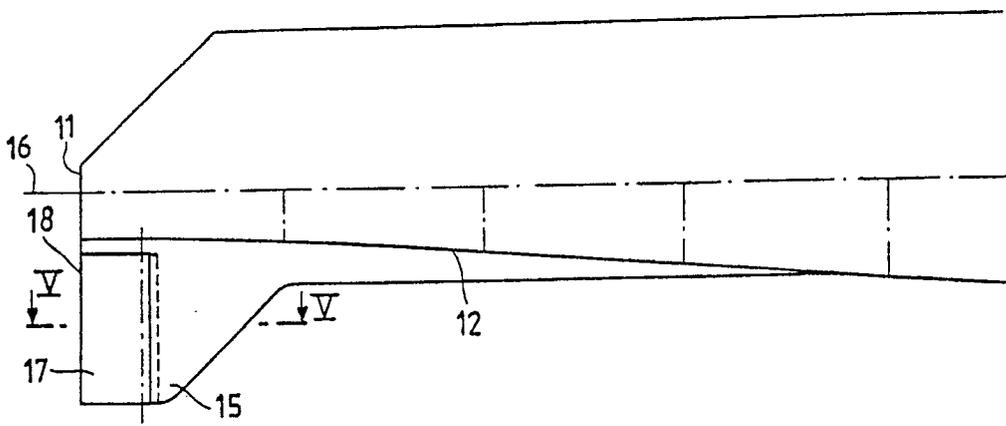
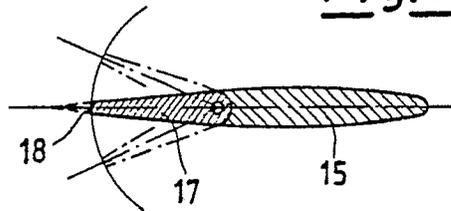


Fig.5



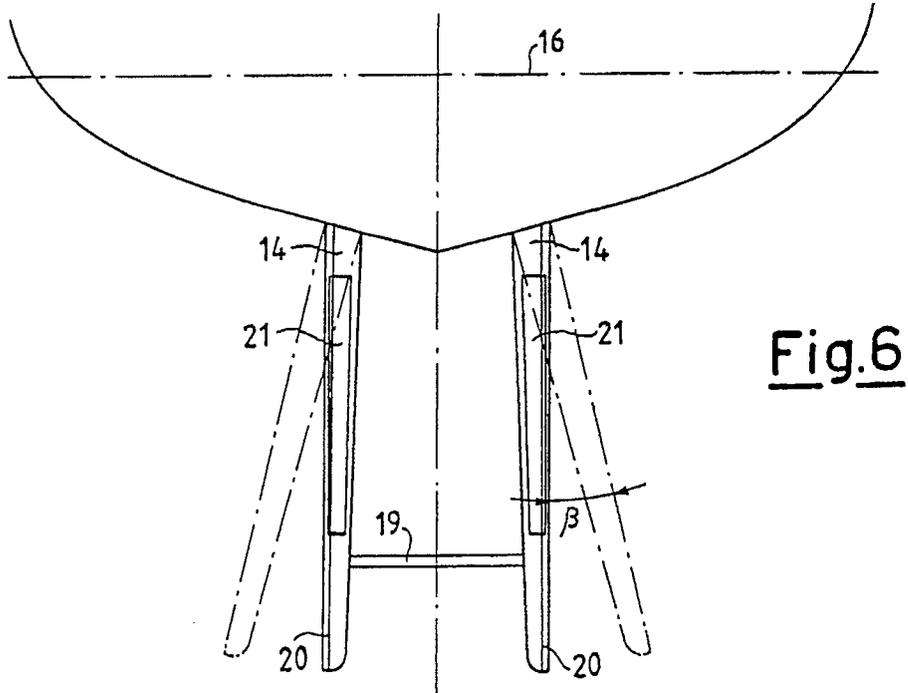


Fig. 7

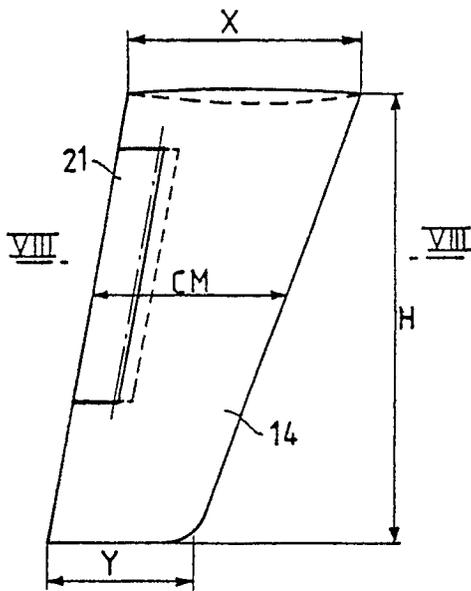
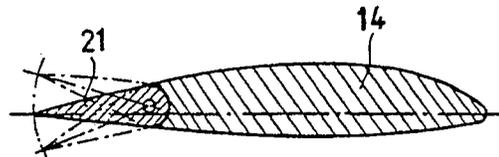


Fig. 8





EUROPEAN SEARCH
REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-2 022 056 (SCHNEIDER) * Page 1, lines 40-55; page 3, lines 40-59; figure 1 * - - -	1	B 63 B 1/04
A	FR-A-2 574 042 (PROVIN) * Pages 2,3; figures * - - -	1,4	
A	DE-A-2 454 877 (JÄGER) * Whole document * - - -	1,5,7,8	
A	FR-A-3 704 74 (HUBER) * Page 2, lines 34-58; figures 1,2 * - - - - -	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 63 B
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		07 February 91	VISENTIN, M.
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