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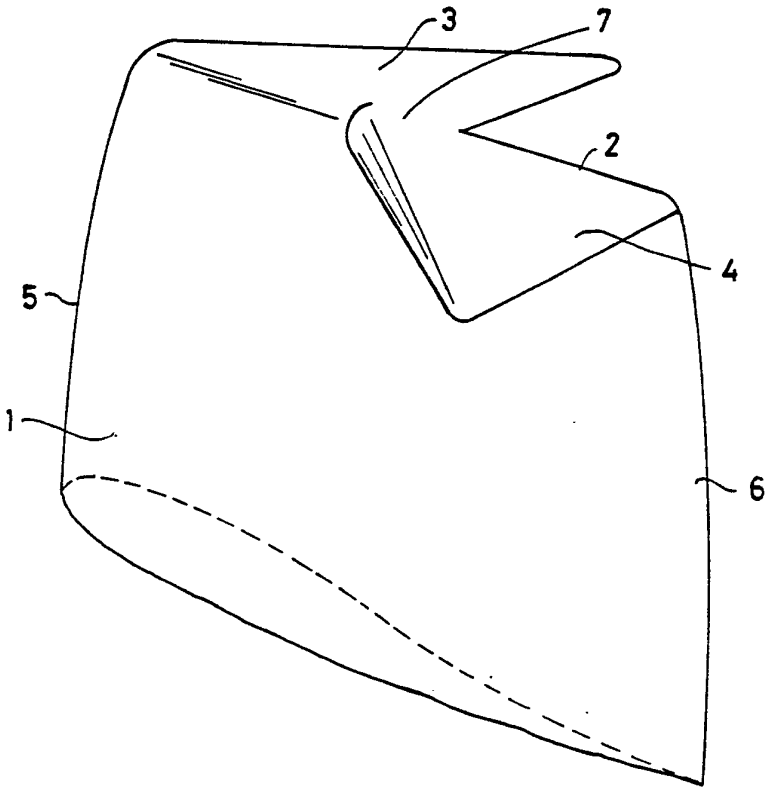
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(54) Title: SHIP'S PROPELLER



(57) Abstract

Ship's propeller provided with propeller blades (1) with end plates (3, 4) at the end remote from the propeller hub and on both sides of the blade (1), whereby on the spot of the attachment to the blade (1) the end plates (3, 4) have a chord length less than the chord length of the blade end (2) and are overlapping each other partly and, whereby one end plate (3) is extending to one blade edge (5) and the other end plate (4) is extending to the other blade edge (6).

* See back of page

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Ship's propeller

The present invention relates to a ship's propeller provided with propeller blades with end plates at the end remote from the propeller hub and on both sides of the blade.

Such a ship's propeller is known. The end plates at the tip of the propeller blades aim to distribute the free vortices coming from the tip of the blade in broadwise direction (= spandirection) of the end plate, so that the kinetic energy losses occured by these free tip vortices remain as low as possible. The end plates however have an important disadvantage. Since they are moved with relatively large speed by the liquid, they intend to a large friction resistance. The energy losses occured by this friction resistance can be so large that the mentioned energy profit is counteracted. It is also known to provide the blades of a ship's propeller at one side of the tip with an end plate. In order to distribute also in this case the tip vortices in the same extension, the width of this endplate must be equal to the sum of the widthes of the plates present on both sides of the tip. Also in this case the friction resistance with respect to the water will be considerable.

The invention aims to provide a propeller with end plates at the blade tips, which has a lower friction resistance with respect to the water than the known propeller.

This is obtained, in that on the spot of the attachment to the blade the end plates have a chord length less than the chord length of the blade end and are overlapping eachother partly, whereby one end plate is extending to one blade edge and the other end plate is extending to the other blade edge.

Since the bound vortices in chord direction are distributed over the blade tip, the whole blade tip must be covered by one or two end plates in order to obtain the desired effect.

According to the invention these vortices are not always distributed over two end plates, such as at the prior art, but substantially over one end plate. The bound vortices present in chord direction at the front side of the blade are namely discharged by the end plate extending to the front edge and the vortices at the back side of the blade by the end plate extending to the back edge. By equalizing the sum of the widthes of the end plates to that of both known end

plates or to the width of the single end plate the same favourable distribution of the discharge vortices in broadwise direction is obtained. Since however the width of each end plate according to the inventor is smaller than that of the known single end plate, and its chord length is smaller than the chord length of the known double end plate, a considerable surface decreasement is obtained by the end plates according to the invention with about a factor 0,4. Since moreover the end plates in the intermediate area of the blade tip overlap eachother, it is obtained that in this area occuring limited vortix strength of the blade tip can be distributed over both end plate halves, in such a way that on the front and back edges of these halves the bound vortix strength can go smoothly to zero to avoid danger of cavitation.

The ship's propeller can be carried out in such a way that on the spot of the attachment the chord lenghts of each end plate is between 90 % and 45 % of that of the blade tip. Preferable however on the spot of the attachment the chord length of each end plate is between 70 % and 45 % of that of the blade tip.

The smallest surface area of both end plates is obtained if on the spot of the atttachment the chord lengths of both end plates are the same.

A special favourable effect can be obtained if the form of the propeller is optimalisized in the way as disclosed in International Ship building Progress, part 34, July 1987 Nr. 395, (An optimum screw propeller with end plates) by J.A. Sparenberg and J. de Vries. The there determined optimal circulation distribution with respect to a propeller provided with end plates can now be applied to determine the further form of the end plates according to the invention. The chord lenghts of the end plates are chosen proportional to said optimal circulation distribution, so that danger for cavitation owing to too large underpresures is avoided. In this respect it is remarked that not the position or angle with respect to the flow of front edge and back edge of the end plate halves are important, but the chord lengths of the end plates.

Finally it is remarked that it is not important whether the front end plate is present at the high pressure or at the low pressure side, provided the back half is present at the other side of the blade.

The invention will now be explained with reference to an embodiment.

Fig. 1a, 1b show respectively a side and front view of the end of a propeller blade with end plates.

Fig. 2 shows the propeller blade according to fig. 1a, 1b perspectively.

Fig. 3 shows the vortix model of the propeller blade according to fig. 2.

Fig. 4a, 4b and 4c show grafically an assumed course of the bound vortix strength over respectively blade and end plates.

The propeller blade 1 shown in fig. 1a, 1b is at his end (not-shown) attached to the hub (not-shown) and at his other end 2 provided with two end plates 3, 4. These end plates have at the side of the end 2 of the blade a chord length which is smaller than the chord length of that end. The end plate 3 is with his front side adjacent to the front edge 5 of the propeller blade, the end plate 4 is with his back side adjacent to the back edge 6 of the propeller blade. In the intermediate area 7 of the end 2 the end plate 3, 4 are overlapping eachother. One and the other is clear from fig. 2.

The vortix model shown in figure 3 (seen under the same angle as fig. 2) the propeller blade is indicated by the bound vortices 8 and the end plates 3, 4 by the bound vortices 9 respectively 10. These last vortices continue in the clearing off free vortices 11 respectively 12. As known the free vortices 11, 12 distributed in such a way give rise to lower losses of kinetic energy compared with a more concentrated clearing off tip vortix which in general is formed at propeller blades without end plates. From this figure it is clear that the end plates 3, 4 do not need to extend over the whole chord length of the end 2, the vortices 8 present at the front side of the blade are guided away as vortices 9 of the end plate 3, the vortices present on the back side of the blade as vortices 10 of the end plate 4.

In fig. 4 an exampel of an assumed course of the bound vortix strength over the blade tip chord c is indicated and from the front and to the back end seen in the flow direction. In fig. 4b, c their belonging assumed course is indicated of the bound vortix strength 3 respectively 4 of the front end plate and the back end plate, as well as over the chord of the blade end. At the overlapping

of both end plates here assumed between 0,35 c and 0,5 c a lineair course is possible. Further to both end plates equal vortix strength must be discharged. The above mentioned can be obtained if it is satisfied to the following two conditions:

1e) $\gamma = \gamma_3 + \gamma_4$

2e) surface figure 4b = surface figure 4c.

CLAIMS

1. Ship's propeller provided with propeller blades with end plates at the end remote from the propeller hub and on both sides of the blade, characterized in that on the spot of the attachment to the blade the end plates have a chord length less than the chord length of the blade end and are overlapping each other partly, whereby one end plate is extending to one blade edge and the other end plate is extending to the other blade edge.

2. Ship's propeller according to claim 1, characterized in that on the spot of the attachment the chord length of each end plate is between 7 % and 45 % of the chord length of the blade tip.

4. Ship's propeller according to one of the preceding claims, characterized in that on the spot of the attachment the chord lenghts of both end plates are the same.

5. Ship's propeller according to one of the preceding claims whereby the circulation distribution along blades and end plates is optimal, characterized in that the chord length of the end plates is proportional to the optimal circulation distribution.

Fig-1a

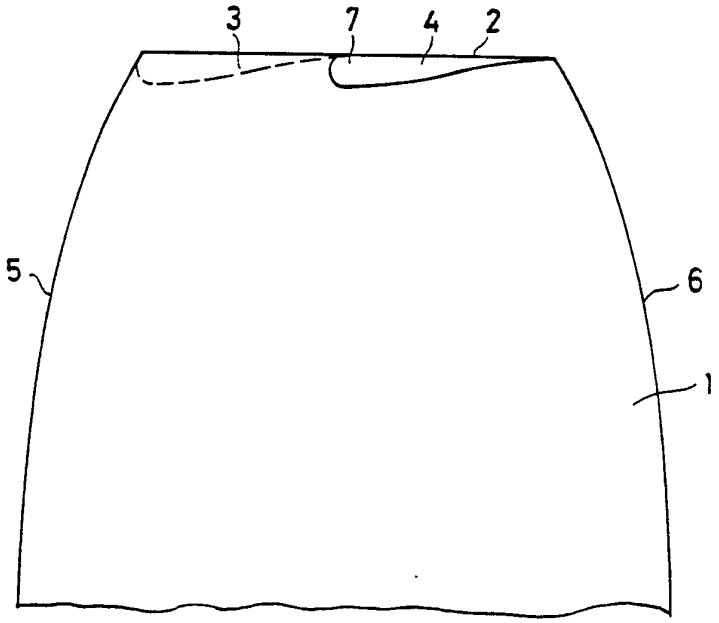


Fig-1b

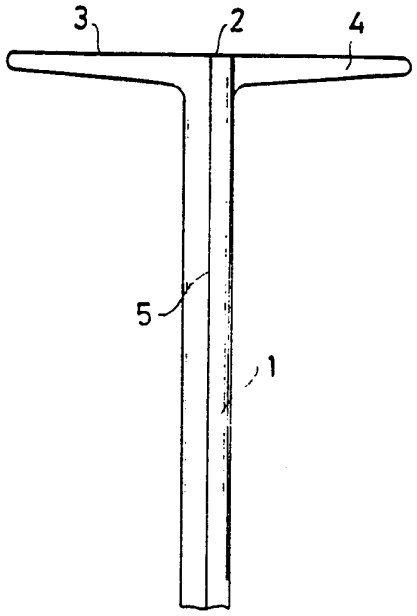


Fig-2

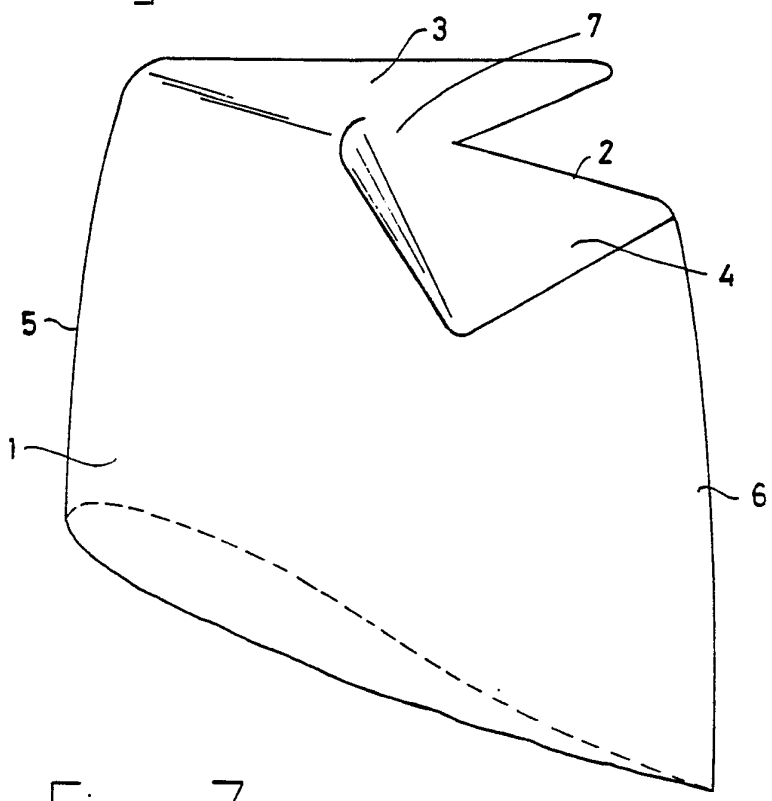


Fig-3

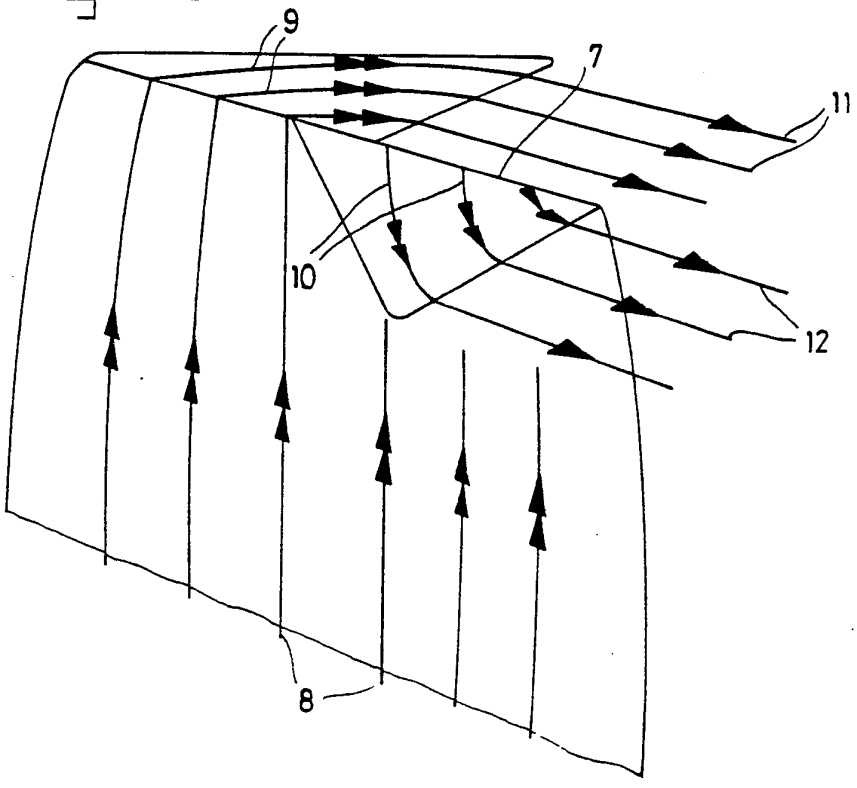


Fig-4a

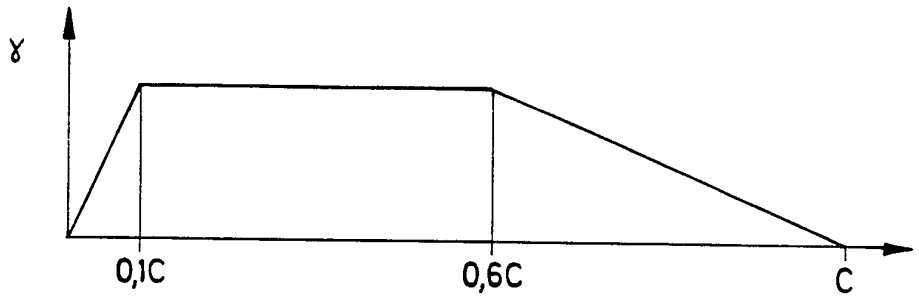


Fig-4b

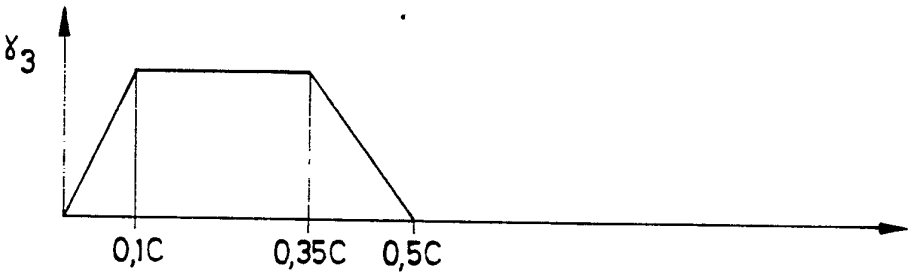
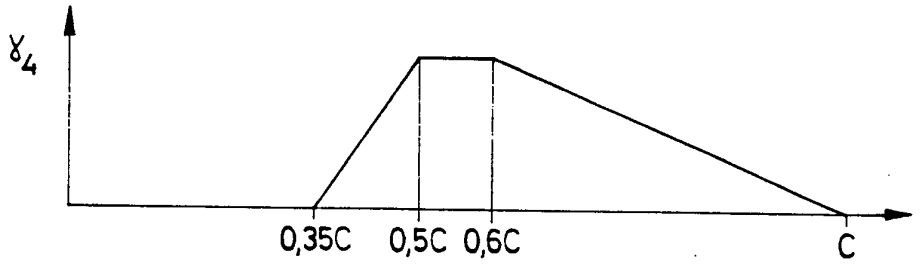


Fig-4c



INTERNATIONAL SEARCH REPORT

International Application No PCT/NL 89/00083

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: B 63 H 1/16

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	B 63 H, B 64 C

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	Patent Abstracts of Japan, vol. 8, no. 37, (M-277)(1474), 17 February 1984; & JP, A, 58194689 (MITSUI ZOSEN K.K.) 12 November 1983, see abstract; figures 4,5 --	1,2
A	Technische Rundschau, vol. 73, no. 10, 3 March 1981, (Bern, CH) S. Iselin: "Flugtechnik. Mehr Auftrieb - weniger Widerstand" page 27, see paragraph "Winglet"; figure 8 --	1,2,5
A	GB, A, 262349 (GOULD) 9 December 1926, see figures 1,2,4 --	1,4
A	DE, C, 899180 (WÖHRN) 10 December 1953, see figures 1,2 --	1
A	FR, A, 2468499 (ASTILLEROS) 8 May 1981, see figure 3 --	1,4

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24th July 1990	24 AUG 1990
International Searching Authority	**Signature of Authorized Officer**
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US, A, 1703412 (THOMPSON) 26 February 1929, see figures 1,2	1,2,4

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. NL 8900083 SA 32565

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 262349		None	
DE-C- 899180		None	
FR-A- 2468499	08-05-81	AU-B- 534883	16-02-84
		AU-A- 6385580	07-05-81
		BE-A- 885914	16-02-81
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		NL-A- 8005991	01-06-81
		SE-A- 8007655	03-05-81
		US-A- 4288223	08-09-81
US-A- 1703412		None	