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(54) **Stabilizer fin**

(57) A stabilizer fin, comprising a tapering body (2) with a symmetrical profile, characterized in that one or more wedge- or ramp-shaped elements (8) are pro-

vided on the lateral surface or surfaces of said body.

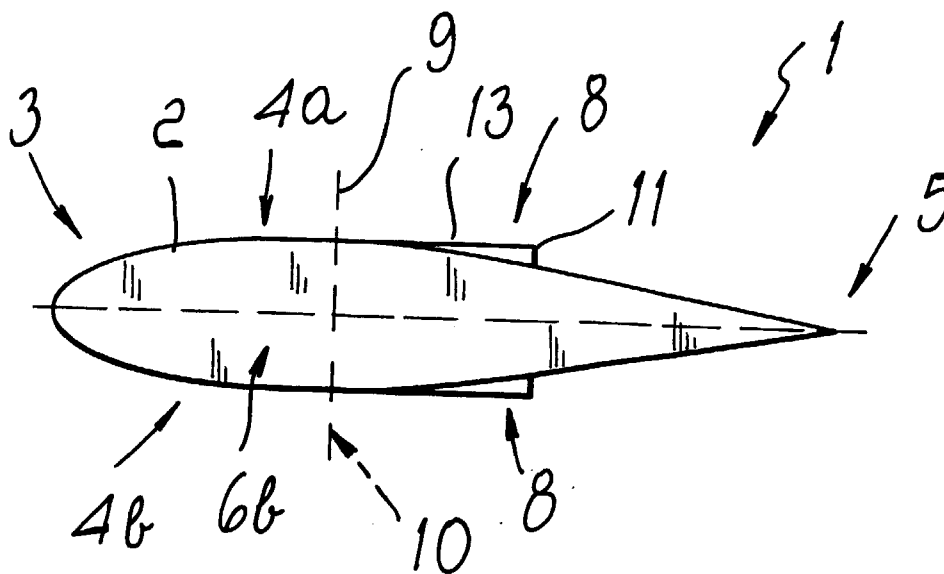


Fig. 2

Description

[0001] The present invention relates to a stabilizer fin, particularly for water-borne crafts.

[0002] EP-0,571,401 discloses a hydrodynamic stabilizer fin, to be used in a submerged condition, which is constituted by a single element having an elongated body at the rear (pointed) end of which there is an element having a substantially wedge-shaped transverse cross-section and in which the vertex is blended with said rear end and the end is flat.

[0003] The function of such conventional fins is substantially to increase lift.

[0004] A drawback of the conventional stabilizer fin is that it can be subject to vibration and also produces noise.

[0005] It is also known to use vorticity-promoting devices which are constituted by elements protruding from the wing and that can be likened to rectangular mini-ailerons which have alternating inclinations with respect to the surface of the wing and are supported by small cylinders.

[0006] Other conventional solutions for achieving lift increases consist, for example, in using movable flaps, which however suffer the drawback that they increase the complexity of the kinematic mechanism of the fin besides having high manufacturing costs.

[0007] However, these solutions still suffer drawbacks, including the fact that they are not ideal as regards solving the problem of stalling.

[0008] The aim of the present invention is to solve the above noted problems, eliminating the drawbacks of the cited prior art, by providing a stabilizer fin, particularly for water-borne crafts, which allows to increase lift and reduce vibrations and noise.

[0009] Within the above aim, an object of the present invention is to provide a fin which is structurally simple and easy to manufacture.

[0010] Another object is to provide a fin which also allows to achieve an improvement in terms of maximum obtainable lift.

[0011] Another important object is to provide a stabilizer fin which has low manufacturing costs and can be manufactured with conventional machines and equipment.

[0012] Another object is to provide a solution which can also be applied in conventional fins by virtue of interventions which have very low costs, so as to allow to increase their roll stabilization effectiveness.

[0013] These and other objects, which will become better apparent hereinafter, are achieved by a stabilizer fin, particularly for water-borne crafts, which comprises a tapering body with a symmetrical profile, characterized in that one or more wedge- or ramp-shaped elements are provided on the lateral surface or surfaces of the body and protrude therefrom.

[0014] Further characteristics and advantages of the invention will become better apparent from the fol-

lowing detailed description of a particular but not exclusive embodiment, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a top view of the stabilizer fin;

Figure 2 is a first side view of the fin;

Figure 3 is a second side view of the fin.

[0015] With reference to the above cited figures, 1 designates a stabilizer fin which is particularly used in water-borne crafts mainly in order to increase their lift.

[0016] The fin comprises a body, designated by the reference numeral 2, which has a tapering shape with a symmetrical cross-section, for example of type known in the literature by the name NACA.

[0017] The body 2 has a first rounded end 3 which protrudes so as to form a pair of first lateral surfaces 4a and 4b which are blended one another at a second pointed end 5.

[0018] The body 2 is transversely provided with two second flat lateral surfaces 6a and 6b, and a shaft 7 for connection, for example, to the keel of a water-borne craft is associated with at least one of such surfaces.

[0019] The stabilizer fin is characterized in that it has, at one or both of the first lateral surfaces 4a and 4b, one or more wedge- or ramp-shaped elements, designated by the reference numeral 8.

[0020] In the illustrated embodiment, the wedges or ramps 8 have an essentially triangular plan shape, in which the base 9 lies approximately at a transverse central plane 10 of the body 2 and the vertex 11 is directed toward the second pointed end 5.

[0021] Each wedge or ramp 8 further has, in a sectional view taken along a plane 12 that passes through an altitude line that connects each base 9 to the vertex 11 and is perpendicular to a transverse central plane of the body 2, a triangular configuration in which one cathetus 13 lies at a plane which is tangent to the intersection of the planes 12 and 10.

[0022] In practice, therefore, the cathetus 13 is part of the upper surface 14 of each wedge or ramp, while the vertex 11 thereof is spaced by a given extent from the adjacent first lateral surface of the body 2.

[0023] Figures 4 to 9 are charts related to measurements taken on a specimen executed according to the teachings of the present invention and conducted in a cavitation tunnel.

[0024] The symbol σ designates the cavitation index, C_L designates the lift coefficient, and α designates the angle of attack.

[0025] Figures 4 and 5 are charts in which the X-axis plots the angle of attack and the Y-axis plots the lift coefficient with a cavitation index of 2 and 3 and considering a test section velocity, designated by V_C , equal to approximately 7 m/s, which corresponds to a Reynolds number (Rn) of 1.7×10^6 .

[0026] A circle (o) designates the values that can be

obtained from a fin without the wedges or ramps and a triangle (Δ) designates the values that can be found with the solution according to the present invention.

[0027] In Figure 5, the chart differs by considering a cavitation index of 3.

[0028] It is thus evident that the lift coefficient equal to 3 is higher in the solution according to the present invention.

[0029] It is also evident that, in the absence of cavitation, the described solution is able to act positively on the boundary layer by delaying its separation, i.e., by extending the curve $C_L - \alpha$ beyond the angle whereat the lift of the fin without the wedges or ramps decreases.

[0030] As one approaches lower cavitation indexes, laminar cavitation at the leading edge (typical for sections working at high angles of attack) causes separation of the boundary layer ahead of the wedge, gradually canceling out its beneficial effects.

[0031] The maximum lift increase that can be obtained with the described solution, in the absence of cavitation, is higher than 10%; it has also been noted that the angle of variation from linear behavior is increased by more than three degrees in the absence of cavitation (in which the cavitation index $\sigma = \text{atm.}$).

[0032] The curves also show that the lift increase can be utilized for high cavitation indexes and angles of attack of the fin; these conditions correspond to low speeds of forward travel of the water-borne craft, which indeed are usually the most critical ones for stabilization systems, thus achieving a great technical advantage.

[0033] Figures 6 and 7 plot the drag coefficient, designated as C_D , considering a cavitation index σ of 3 and 2 respectively.

[0034] It is thus noted that, again in the absence of cavitation, a decrease in drag is appreciable, confirming the correct operation of the described solution.

[0035] The boundary layer between two adjacent wedges or ramps becomes thinner and part of the boundary layer that had formed upstream along the cord is expelled in the external flow of the wedge or ramp.

[0036] All this acts so as to reduce the tangential tensions which generate the friction drag of the section.

[0037] Further, for high angles of attack, the fact of delaying separation allows to decrease the form drag of the section.

[0038] It has thus been observed that the invention has achieved the intended aim and objects, and that a stabilizer fin has therefore been obtained in which, in addition to increasing the lift of the profile, drag has also been reduced, furthermore considerably increasing the efficiency of the wing, defined by the ratio C_L/C_D .

[0039] Figures 8 and 9 plot these ratios and therefore plot the trends of the efficiency of the fin as the angle of attack varies.

[0040] In general, one observes an increase in efficiency, especially at the lower angles of attack; this

introduces another technical advantage, since for an equal lift the illustrated solution offers less drag contrasting the motion of the water-borne craft.

[0041] Moreover, the measurements made show that the described solution does not have particular degradations as regards cavitation and indeed it has been found that in some conditions it is able to reduce bubble cavitation on the blade of the stabilizer.

[0042] Finally, the illustrated solution can be easily manufactured and obtained even on conventional fins, since the modification can be achieved rapidly and easily.

[0043] The invention is of course susceptible of numerous modifications and variations, all of which are within the scope of the same inventive concept.

[0044] Likewise, the materials and the shapes that constitute the wedges or ramps, as well as their number, arrangement and spacing, can be the most pertinent according to specific requirements.

[0045] The disclosures in Italian Patent Application No. TV99A000102 from which this application claims priority are incorporated herein by reference.

[0046] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A stabilizer fin, particularly for water-borne crafts, comprising a tapering body with a symmetrical profile, characterized in that one or more wedge- or ramp-shaped elements are provided on the lateral surface or surfaces of said body and protrude therefrom.
2. The fin according to claim 1, characterized in that said body has a first rounded end which forms two first lateral surfaces which are blended one another at a second pointed end and is transversely provided with a pair of second lateral flat surfaces, said wedge- or ramp-shaped elements being provided at one or both of said first lateral surfaces.
3. The fin according to claim 2, characterized in that said wedges substantially have a triangular plan shape, in which the base lies approximately at a transverse central plane of said body and the vertex is directed toward said second pointed end.
4. The fin according to claim 3, characterized in that each one of said wedges or ramps has, in a cross-section taken along the plane that passes through the altitude that connects each one of said bases to the vertex and is perpendicular to the transverse

central plane of said body, a triangular shape in which one cathetus lies at a plane which is tangent to the intersection between said transverse central plane of said body and said plane that passes through the altitude that connects each one of said bases to said vertices and is perpendicular to said transverse central plane of said body. 5

5. The fin according to claim 4, characterized in that said cathetus is part of an upper surface of each one of said wedges, while said vertex is spaced by a chosen extent from the adjacent first lateral surface of said body. 10

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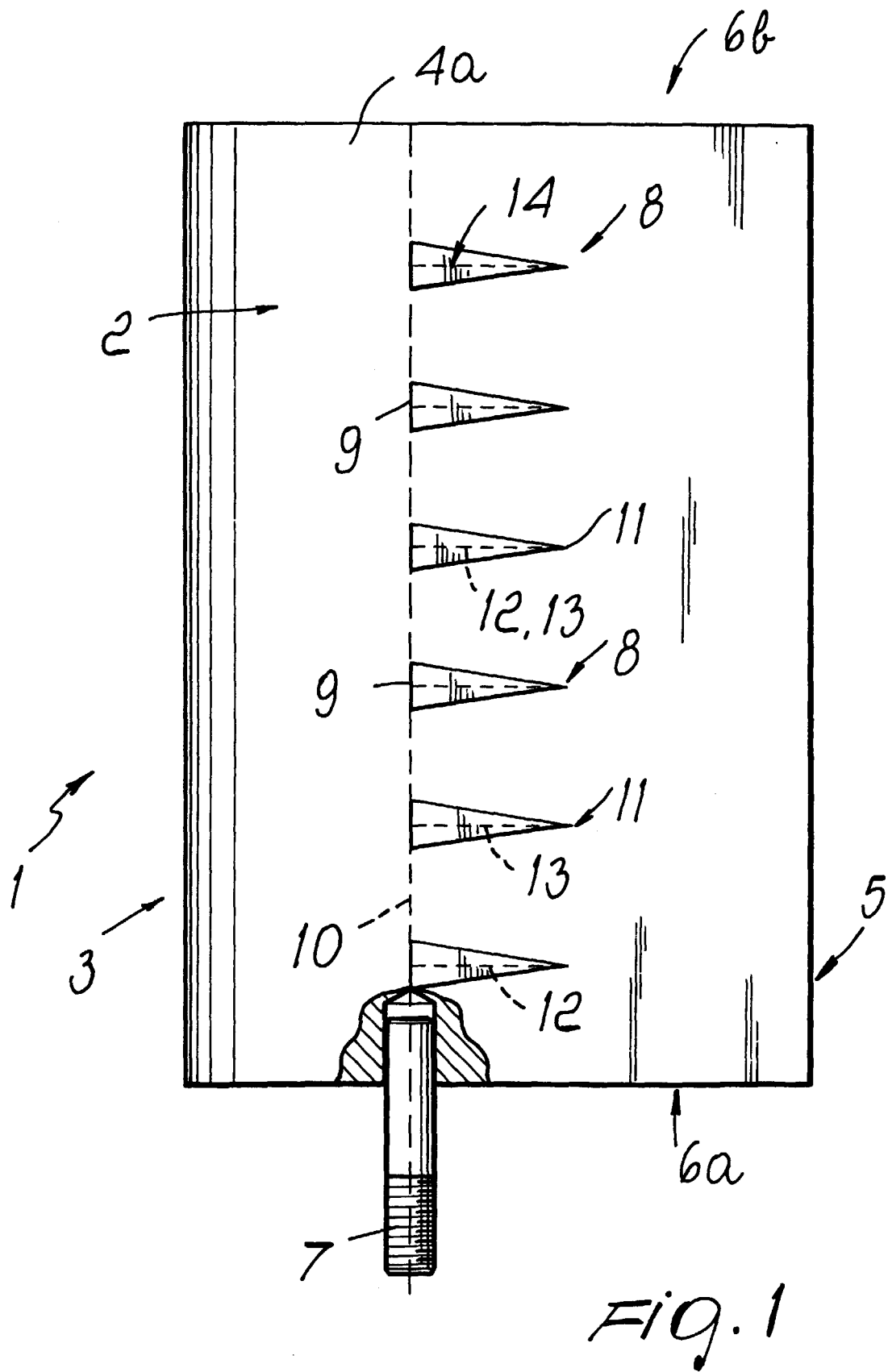
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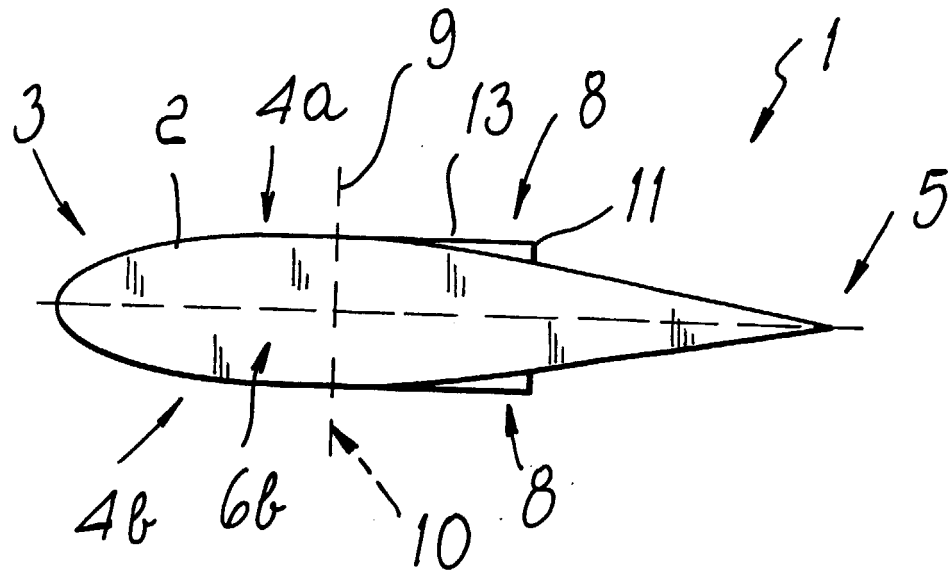


Fig. 2

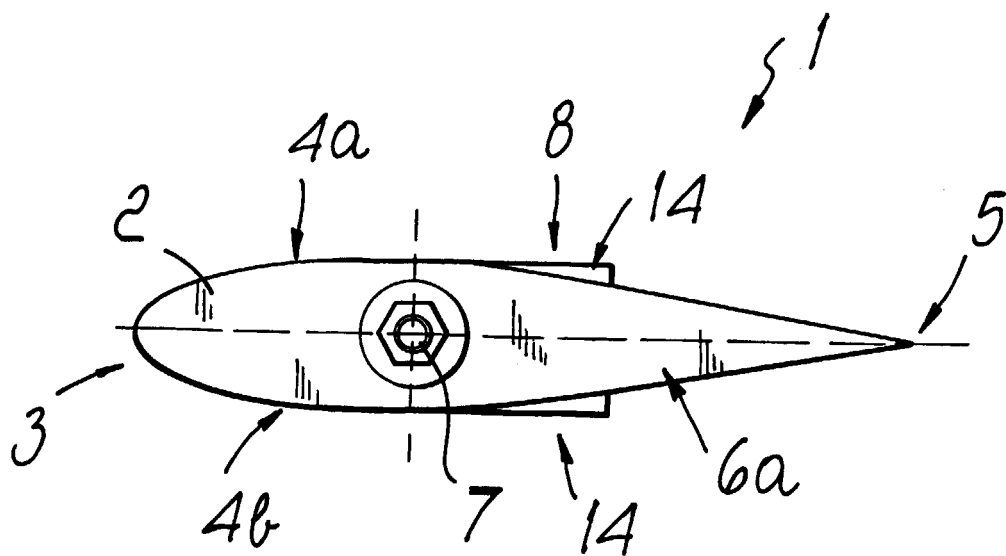


Fig. 3

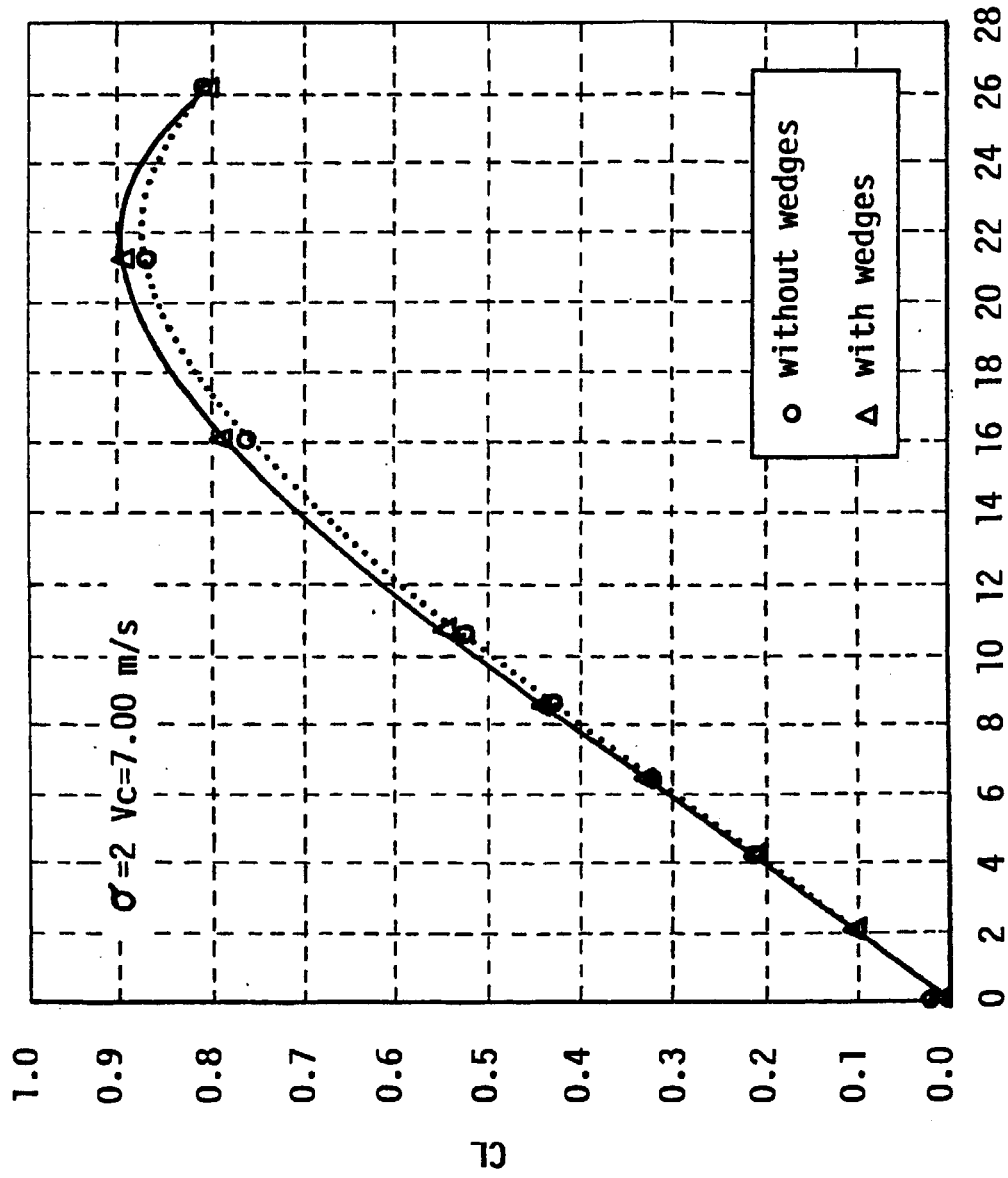


Fig. 4

CORRECT ANGLE OF ATTACK
 Lift coefficient for $\sigma=2$

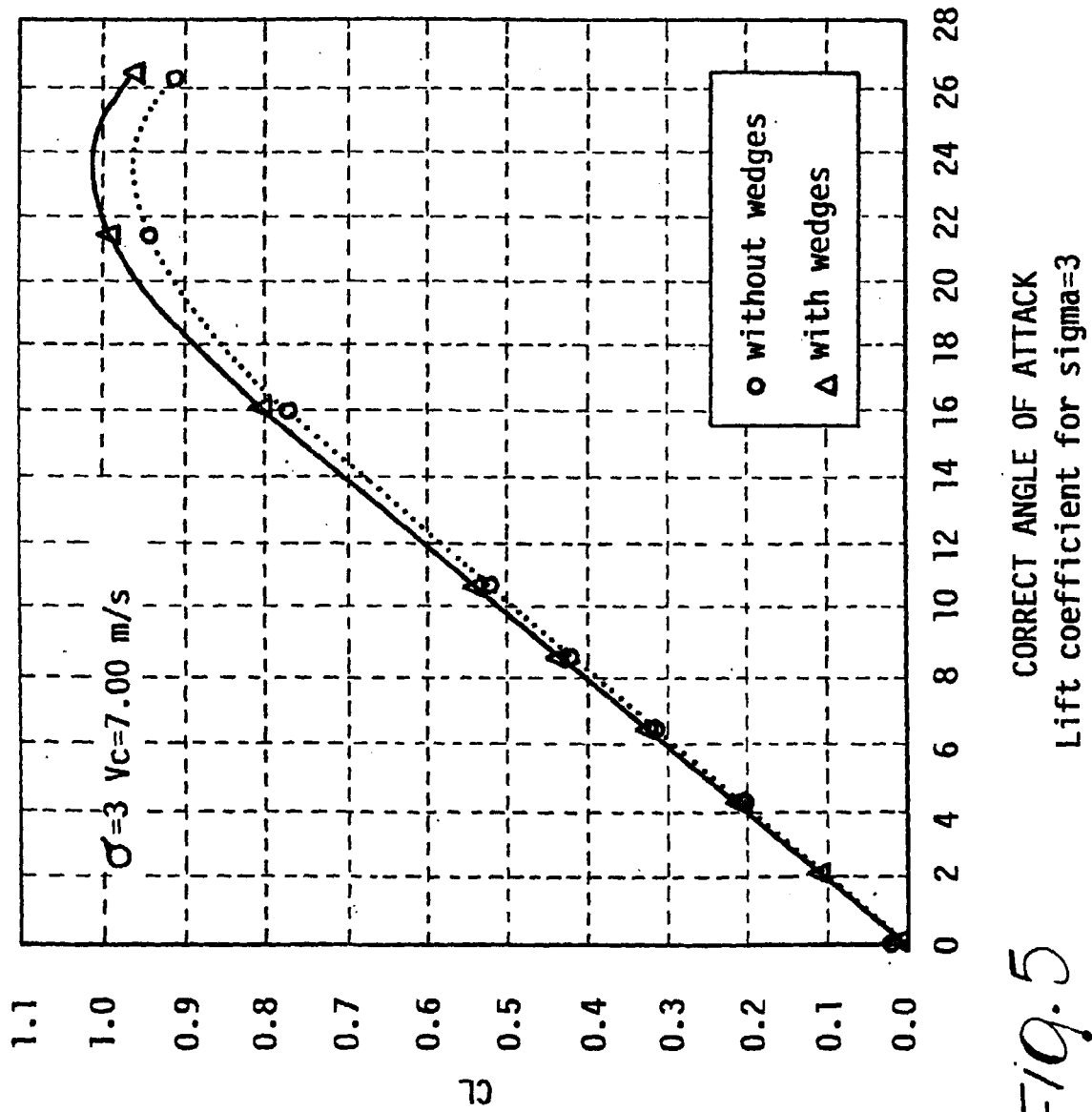


Fig. 5

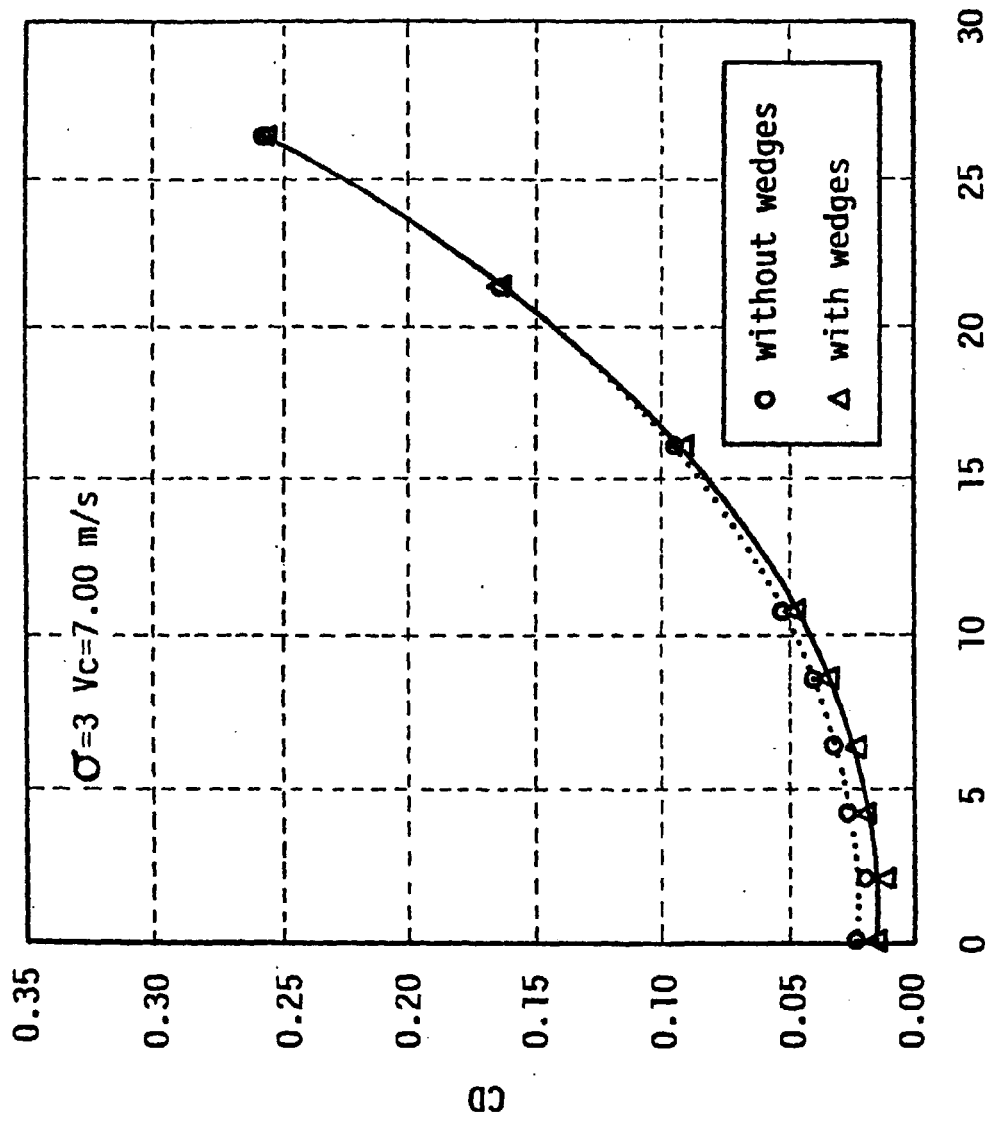


Fig. 6
 CORRECT ANGLE OF ATTACK
 Drag coefficient for $\sigma=3$

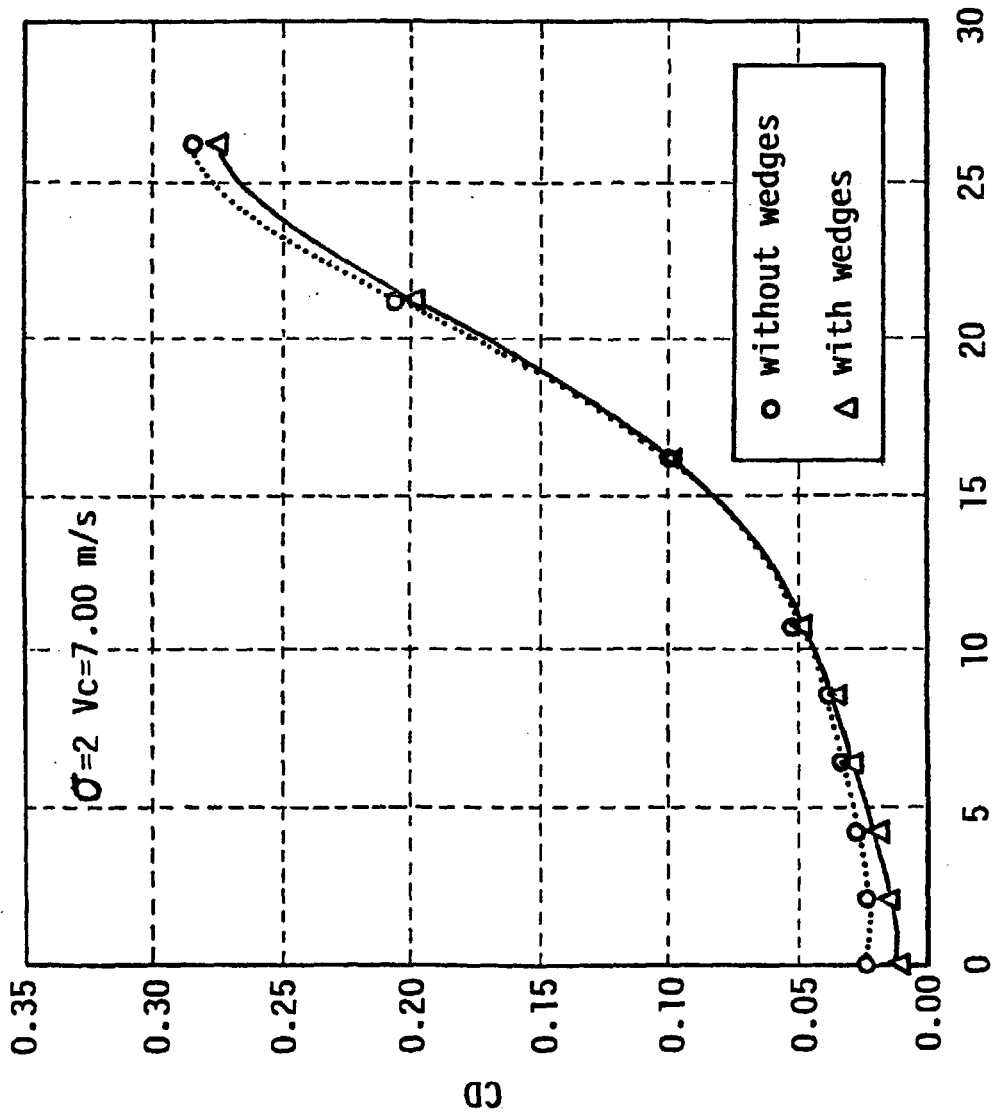


Fig. 7
 CORRECT ANGLE OF ATTACK
 Drag coefficient for $\sigma=2$

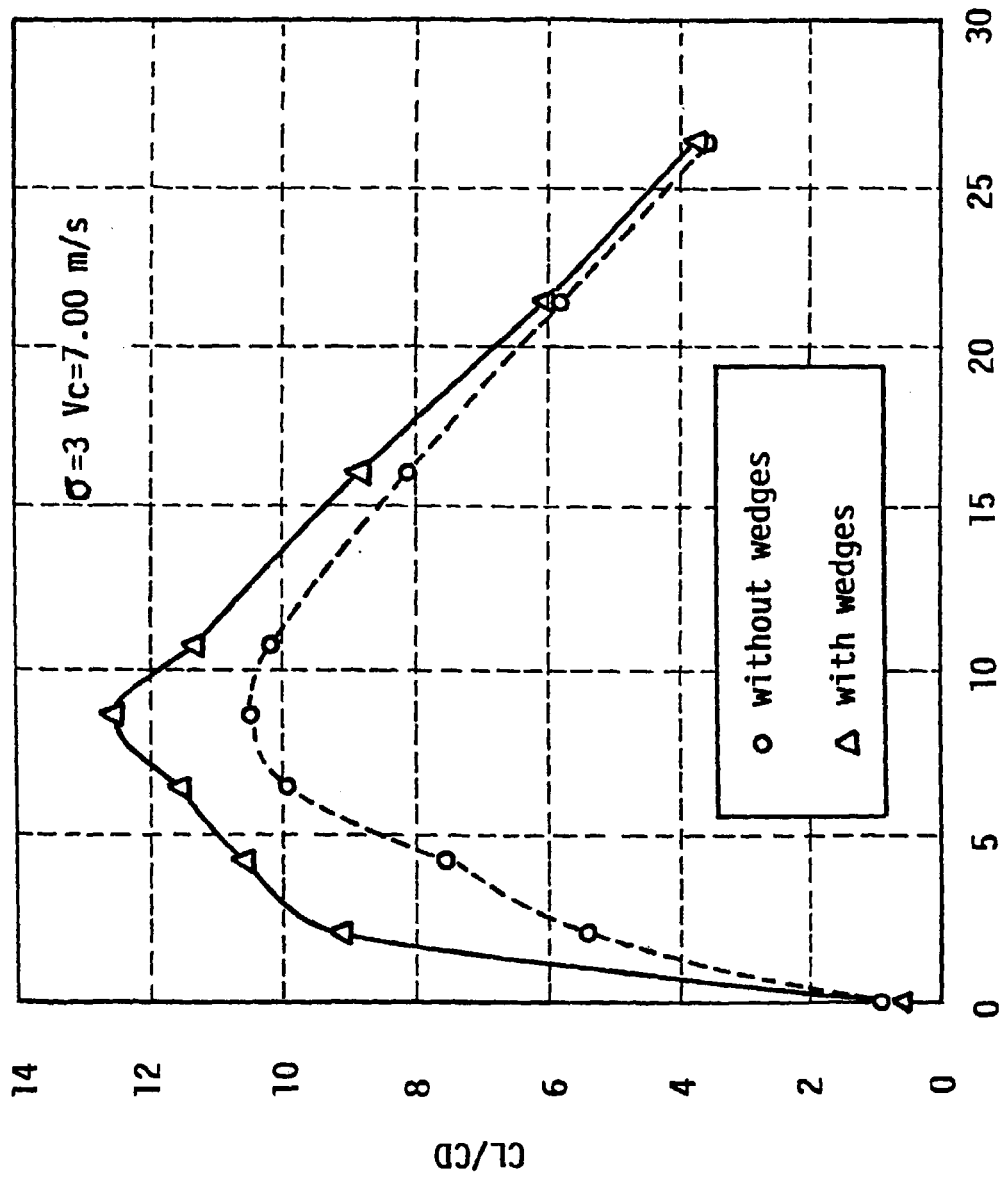


Fig. 8

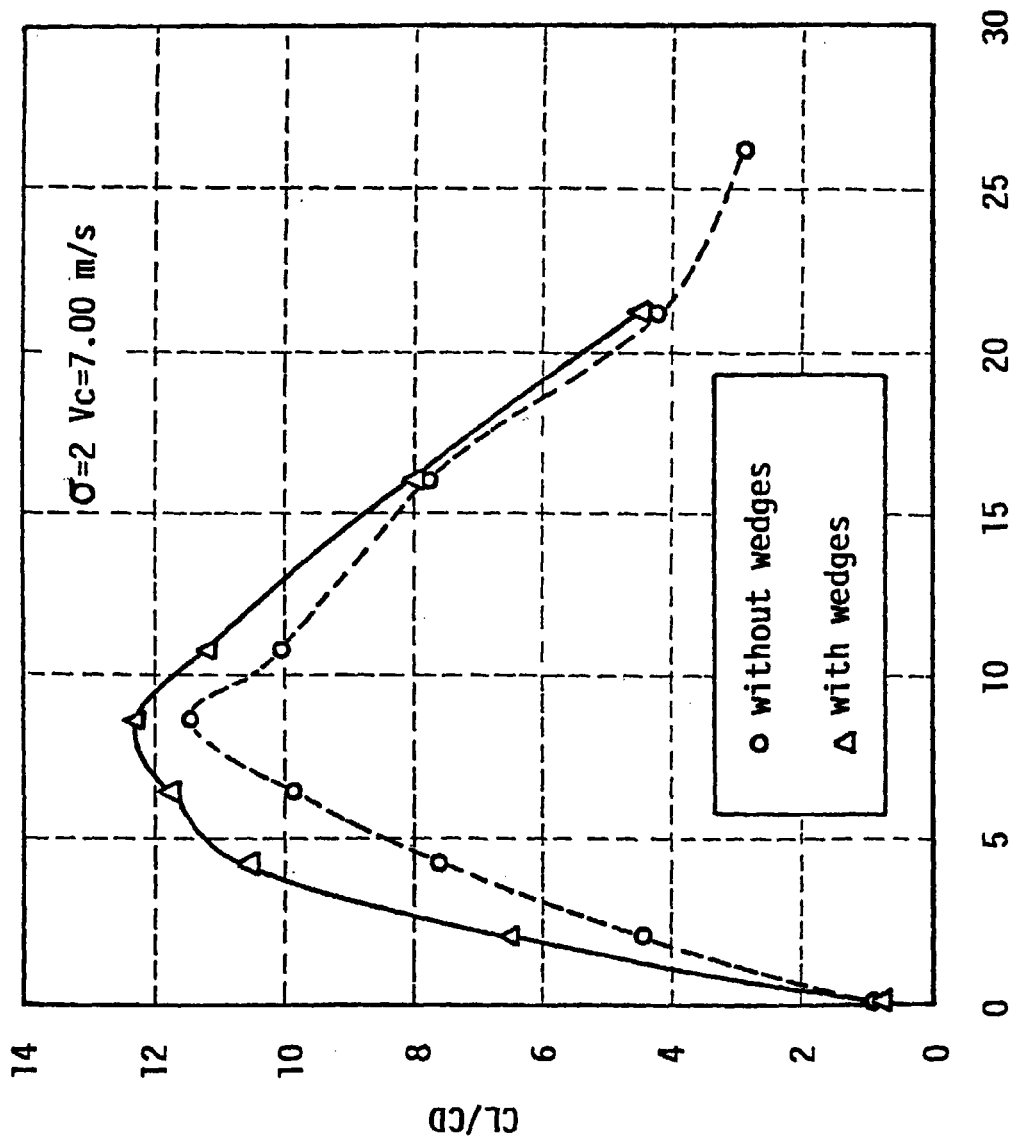


Fig. 9

CORRECT ANGLE OF ATTACK
Fin efficiency for $\sigma=2$