United States Patent

[11] **3,570,438**

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[33] **Poland**
[31] **P123.218**

[54] **PROFILED STABILIZING FIN FOR A SHIP**
9 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **114/126**
[51] **Int. Cl.** **B63b 39/06**
[50] **Field of Search** ..... 114/126, 66.5 (H)

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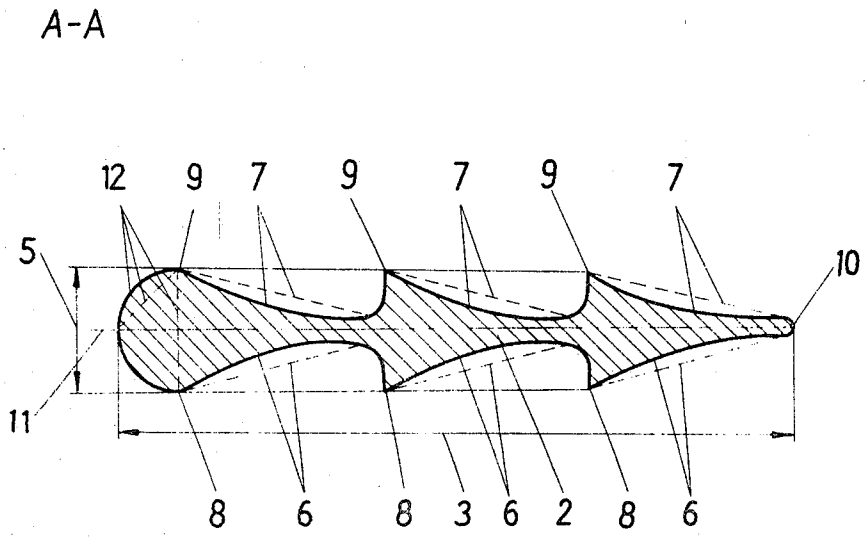
Attorney—Irvin A. Lavine

ABSTRACT: A ship with stabilizing fins either laterally extending or forming the bilge keel, which fins are fixed and which have thin leading edges, an upper surface that is concave, and a lower surface that diverges from the upper surface.



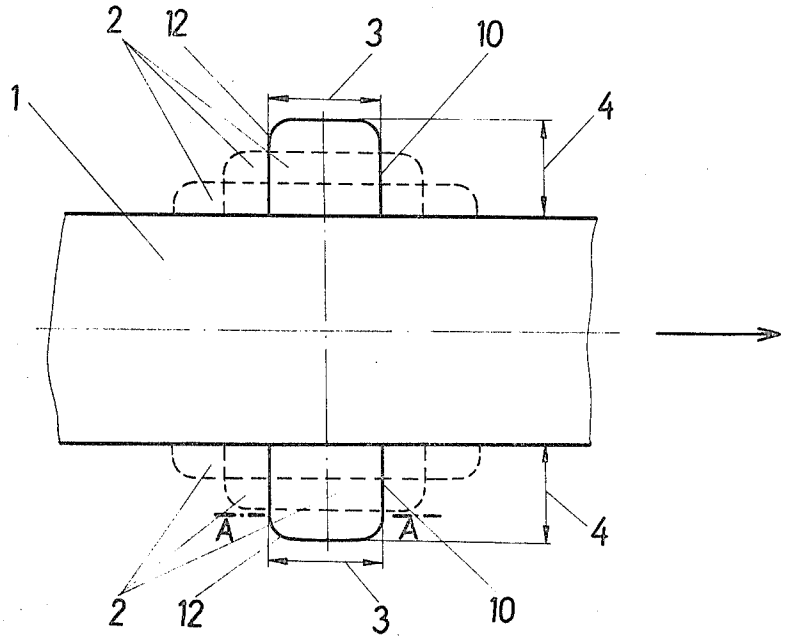


Fig. 1

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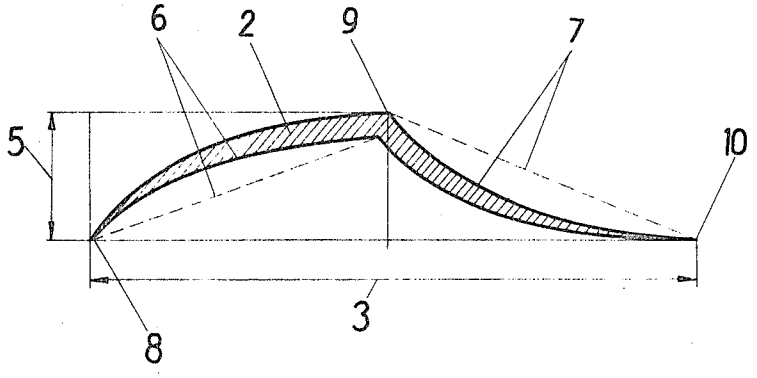

Fig. 2

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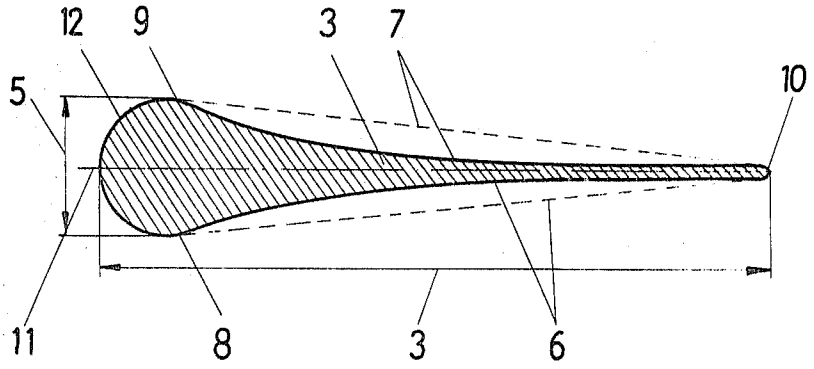

Fig. 3

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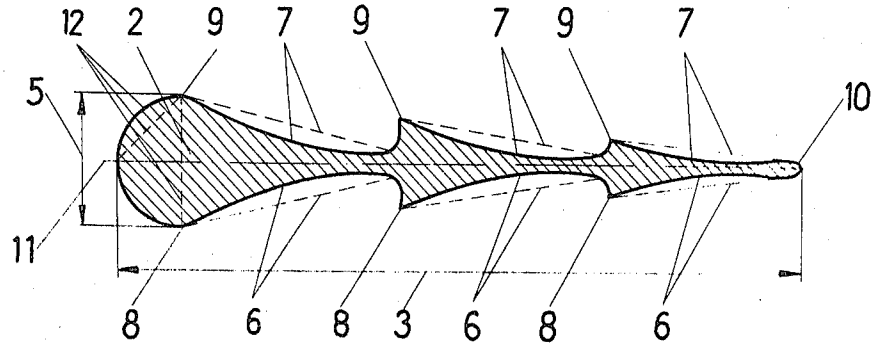

Fig. 4

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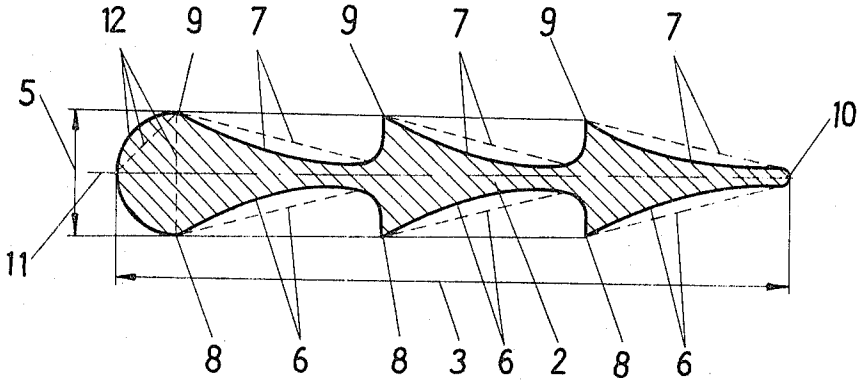

Fig. 5

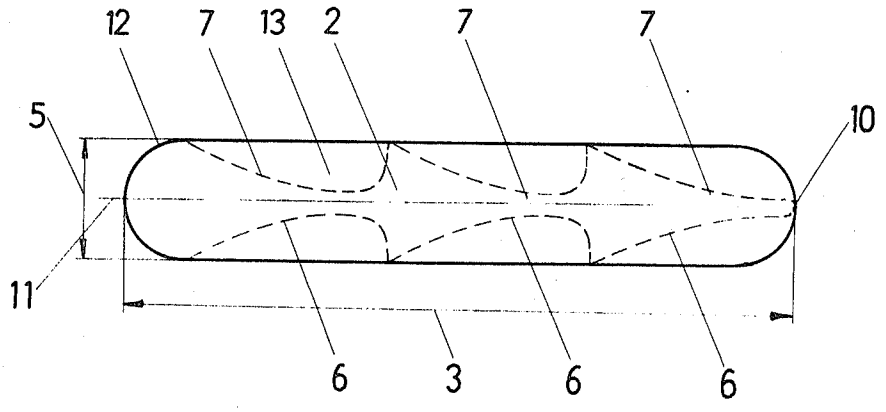

Fig. 6

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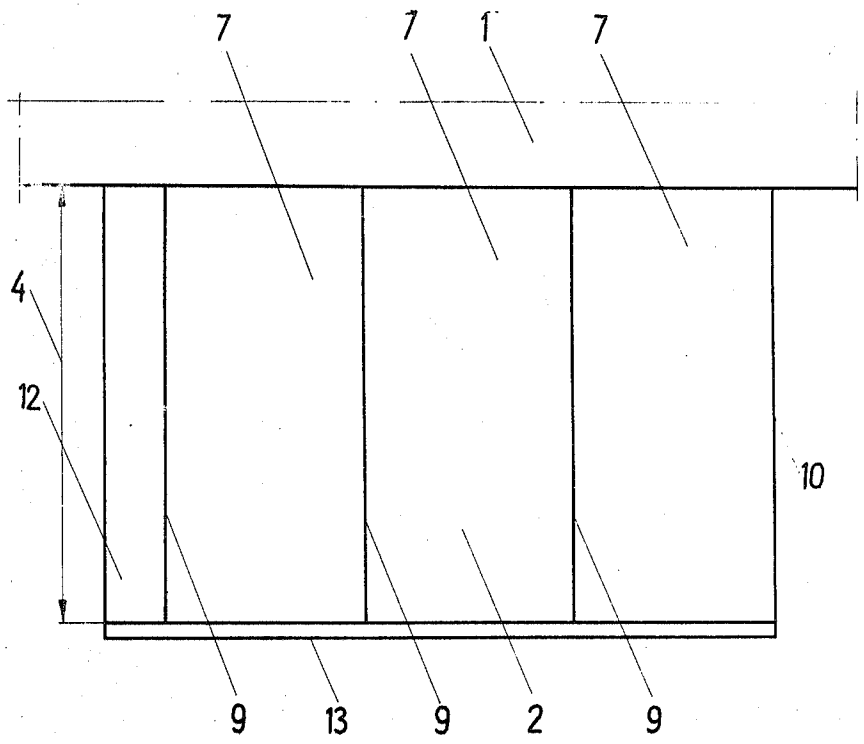

Fig. 7

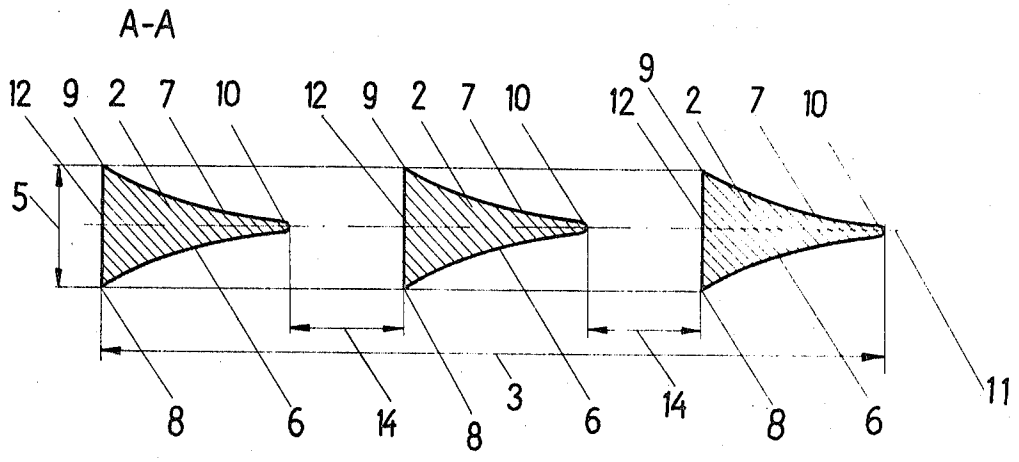

Fig. 8

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PROFILED STABILIZING FIN FOR A SHIP

The hitherto-known engineering solutions to the problem of fixed (constant angle of incidence) and movable (variable angle of incidence) stabilizing fins have been chiefly based on the straight-line or convex, sectional and circular profiles, and primarily, on the aircraft-type profiles which for achieving the required stabilizing force exert certain oscillatory movements in relation to the hull of the ship.

Although these known solutions are somewhat effective, nevertheless in the form of bilge keels (as this has been proved by the latest hydrodynamic investigations) they cannot make full use of the total working surface (lower and upper) of the fins during stabilization work and during the actual speed of advance of the ship, which fact leads in both cases to lower efficiency in the damping of ship oscillations. Moreover, when made in the form of extensile activated fin stabilizers with aircraft profiles, they call for additional auxiliary facilities in the form of a gyroscope control system and electrohydraulic gear for continuously changing the angle of incidence of the fins which is a factor in making such equipment more expensive to install on the bigger floating units.

Engineering developments presented under this invention have for their objective the elimination of the aforementioned technical imperfections and a marked consequential increase in stabilizing efficiency of bilge keel and extensile fin stabilizers, and importantly, elimination of the gyroscope control system and electrohydraulic gears by substituting the oscillatory motion of the fins with adequately high-effective profile (of profiles) of a constant angle of incidence just as it is the case with the bilge keels.

The specific design features of these fixed stabilizing fins lie in their asymmetrical or symmetrical profile disposed on the bilges along the central part of the hull of the ship, both working planes (lower and upper) of which possess a certain convergence in the direction of the ship's bow. The planes noted may be straight line of they can have a concave curvature. Especially important in this case is the multiple profiling of each of the lower and upper working plane of the stabilizing fin whose individual rear edge heights either decrease as they near the bow of the ship along the line of the hull, or are of the same height or they may also be provided under a system of individual elementary working planes interconnected to form one integral unit, or spaced along the central part of the ship's hull at a certain distance, thus producing the so-called intermittent system. Additionally, there may be also provided on the outer end of these fixed stabilizing fins so-called limiting plates to confine the finite width of the fin and to ensure the best distribution of liquid flow during the damping of oscillations.

The present invention has been illustrated by means of exemplary constructional embodiments shown in the attached drawings, where:

FIG. 1 shows a plan view of the central part of a ship's hull with fixed stabilizing fins (stretched out beyond the ship's hull outlines) of varying basic dimensions;

FIG. 2 is a cross section taken on line A–A of FIG. 1 showing a first embodiment of the invention;

FIG. 3 is a similar cross section of a second embodiment;

FIG. 4 is a similar cross section of a third embodiment;

FIG. 5 is a cross section of a fourth embodiment;

FIG. 6 is an elevational view of the fin as shown in FIG. 5, with a limiting plate;

Flg. 7 is a plan view of the stabilizing fin of FIG. 6; and

FIG. 8 is a similar cross section of another embodiment.

Thus, the disclosed profiled fixed stabilizing fins for damping the pitching and rolling of the ship, installed in the central part of a ship's hull 1 (FIG. 1) on bilges on both sides of the ship as fins 2 of length 3, width 4 and thickness 5 are characterized chiefly in that the first constructional embodiment (FIG. 2) has a two part discontinuous upper surface 7 and a two part discontinuous lower surface 6 which together define a forward section which is upwardly concave and which is of increasing thickness from the thin leading edge 10 to the upper surface discontinuity line 9 which latter thereby establishes the thick rear edge of the forward section. The rear edge of the forward section is located above the level of the leading edge 10, and has integral therewith the forward edge of a rear section which is downwardly concave and which is defined by the said upper and lower surfaces which converge to a thin trailing edge 8 located at about the same level as the leading edge 10.

According to the second constructional embodiment (FIG. 3) the lower and the upper concave working surfaces of the stabilizing fin 2 are symmetrically profiled relatively to a central plane 11, these surfaces 6 and 7 being convergent in the direction of the ship's bow and, whose rear edges 8 and 9 are equidistant from the plane 11 and are joined by a rearwardly convex trailing edge 12.

According to the third constructional embodiment (FIG. 4), the lower and the upper working surfaces 6 and 7 of the stabilizing fin 2 each comprises plural surface parts. The lower surface 6 has three such parts each being concave downwardly and terminating at a rear edge 8 displaced from the central plane 11, while the upper surface 7 has three such parts each concave upwardly and terminating at a rear edge 9 displaced from the central plane 11. These surfaces thereby define three fin sections each having a thin forward portion and a thicker rearward portion. The rearmost fin section has a rearwardly convex trailing edge 12 joining the rear edges 8 and 9 thereof, and each fin section has the rearward portion thereof of greater thickness than the rearward portion of the fin section of it.

According to the fourth constructional embodiment (FIG. 5), the lower and the upper surfaces 6 and 7 of the stabilizing fin 2 have substantially the same configuration as in FIG. 4, except that the rearward portion of the several fin sections are of the same thickness.

According to the fifth constructional embodiment (FIGS. 6 and 7), the lower and the upper working surfaces of the stabilizing fin 2 is similar to that in embodiment 4 (FIG. 5), but the fin 2 has on its outboard end limiting plate 13 to provide a finite width of the fin 2.

Finally, according to the sixth constructional embodiment (FIG. 8) three fins 2 are provided one behind the other and lying along a central plane of symmetry 11. Each fin 2 has a lower downwardly concave surface extending rearwardly from thin leading edge 10 and with a rear edge 8 displaced from plane 11, and an upper upwardly concave surface 7 extending rearwardly from thin leading edge 10 to a rear edge 9 displaced from plane 11. The edges 8 and 9 are equidistant from plane 11 and are joined by flat trailing surface 12 perpendicular to plane 11. The leading edge 10 of one fin 2 is spaced rearwardly by a space 14 from the trailing surface 12 of the fin 2 in advance thereof. Each of the fins 2 is of substantially the same size and shape. This construction provides an intermittent fin system.

There are of course possible various combinations of the above-specified constructional developments of the fins by intermixing their structural elements; this applies in particular to the symmetry of configuration covering both working surfaces 6 and 7 of the continuous system (FIGS. 2, 4 and 5) and intermittent system (FIG. 8) of the stabilizing fins 2, and to the possibility of using in each development mentioned the limiting plate 13 (FIGS. 6 and 7), and also to the multiple part surfaces.

All the above-specified constructional developments covering the profiled fixed stablilizing fins can be of individual practical workability according to the actual size and ship's speed and depending on to what extent the pitching and rolling of the ship are to be reduced.

The principle of operation of the fixed stabilizing fins made in the form of bilge keels as well as extensile fin stabilizers is the following: due to the shaft of the working surfaces of the stabilizing fin 2 there is an increase in the front resistance of the fin and the angle of attack of the liquid flowing over the stabilizing fin during rolling of the ship making headway under

sea-voyage conditions, which fact exerts in accordance with the basic principles of hydrodynamics direct influence on the growing profile lift and hence also on greater stabilization of rolling and pitching conditions of the ship.

Besides, on account of the two-sided profiling of the working surfaces, the said type of profiled fixed stabilizing fins is always operating with the full surface of the fin acting in both directions, i.e., during the listing motion as well as during the returning of the ship to its initial state of equilibrium.

The profiled fixed stabilizing fins of the present invention have been subjected to laboratory verification tests which proved in full effectiveness thereof.

It has been found, among other facts, that the constructional embodiment of the profile stabilizing fin, as shown in FIG. 2, is especially suitable in the form of bilge keels where smaller floating units are involved. The exemplary embodiment of the stabilizing fin as shown in FIGS. 3, 5, 6 and 8, in the form of bilge keels is effective for medium large and large floating units. And finally, profiled fin development as shown in FIGS. 3 and 4 in the form of fins extended beyond the contours of the ship's hull, in both single, and multiple-finned oscillation stabilizers have a very high damping efficiency in the case of medium large and large floating units.

I claim:

1. In a ship's hull having stabilizing fin means extending therefrom, the improvement wherein said stabilizing fin means comprises plural upper and lower surface parts defining first and second sections, the first section being upwardly concave and the upper surface part thereof being concave, said first section having a thin leading edge and a thick rear edge located at a height thereabove, said second section extending from the thick rear edge of said first section to a thin trailing edge, said second section being downwardly concave.

2. In a ship's hull having stabilizing fin means extending therefrom, the improvement wherein said stabilizing fin means comprises plural upper and lower surface parts each diverging rearwardly from a relatively thin forward portion and with each said upper surface part being concave.

3. The structure of claim 2, said stabilizing fin means being stationary relative to said hull.

4. The structure of claim 2, said stabilizing fin means having limiting plate means at the outboard end thereof.

5. The structure of claim 2, wherein the rearward portion of each fin section is of greater thickness than the rearward portion of the fin section in advance thereof.

6. The structure of claim 2, wherein said rearward portions of said fin sections are of substantially the same thickness.

7. The structure of claim 2, wherein said stabilizing fin means comprises plural fin sections.

8. The structure of claim 7, said fin sections being immediately adjacent.

9. The structure of claim 7, said fin sections being spaced apart to provide an intermittent fin system.