July 8, 1958 F. VERTENS 2,842,083

HYDROFOIL ARRANGEMENT

Filed Nov. 24, 1954

Fig. 1

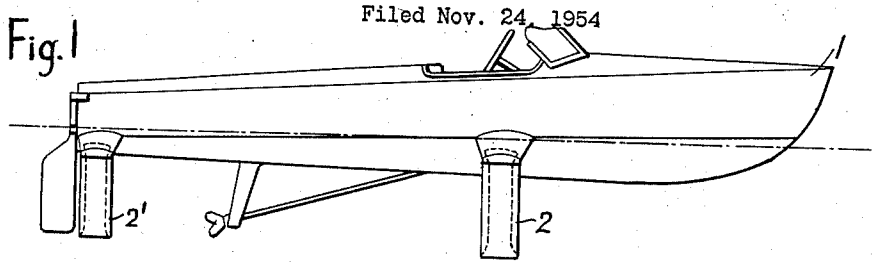


Fig. 2

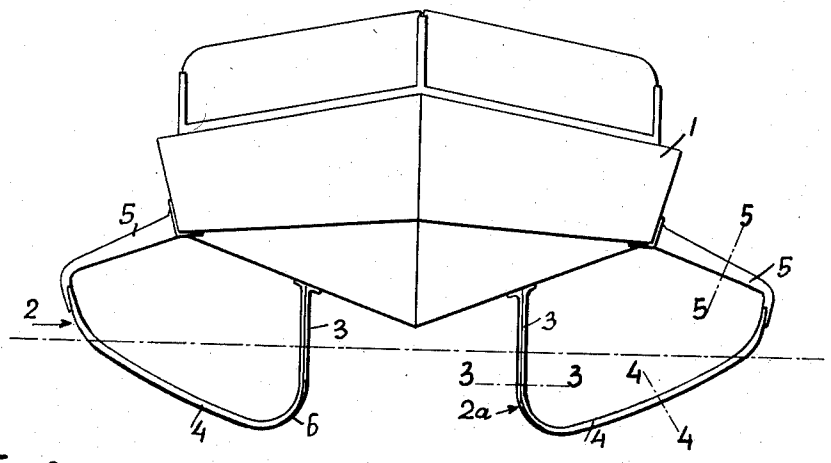


Fig. 3

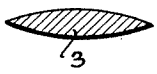


Fig. 4

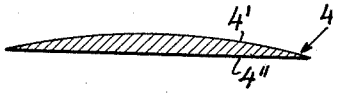


Fig. 5

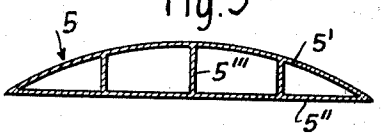


Fig. 6

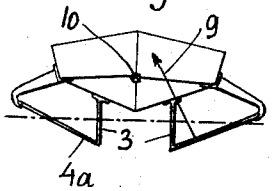


Fig. 7

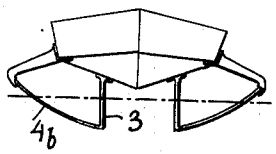


Fig. 8

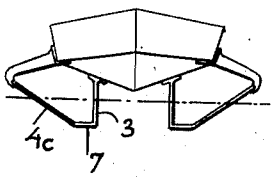
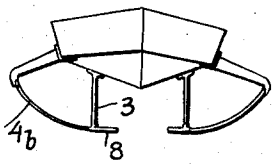


Fig. 9



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HYDROFOIL ARRANGEMENT

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6 Claims. (Cl. 114—66.5)

The present invention relates to hydrofoils, and more particularly to a hydrofoil arrangement for speed boats.

According to the prior art hydrofoils having a semi-circular, trapezoid, or V-shaped outline are known, whose upper ends projects above the water surface. The hydrofoils are arranged below the forward part of the boat which may extend through one-third or one-fourth of the length of the boat, and below the rearward part of the boat. When hydrofoils of this type are provided on a boat having a high Froud number, that is on a boat which is small and very fast, it is necessary to construct the hydrofoils greater than is required only for producing the optimal lifting force, since the hydrofoils must have a sufficiently strong structure to resist the water pressure. This is disadvantageous, since portions of the hydrofoil, which are not required for producing a lifting force, have to be dragged through the water and produce an unnecessary and consequently detrimental resistance against movement.

Another type of hydrofoil construction is known which overcomes this disadvantage by omitting a hydrofoil portion extending transversely underneath the hull, and by providing two separate V-shaped hydrofoils on both sides of the hull. The separated lateral hydrofoils according to the prior art have the disadvantage that a craft provided therewith does not pass well through curves. On the other hand, boats having the hydrofoils of the first described type operate very well in curves. When the boat moves outwardly in a curve, the inclined portions of the hydrofoils which pass through the water surface are exposed to an asymmetrical flow of water. Due to the displacement of the boat in a curve, the effective incidence angle of the hydrofoil with respect to the direction of flowing water is greater on the side of the boat which is located outwardly with respect to the curve than on the side of the boat which is located inwardly. Consequently, a greater lifting force is produced on the outwardly located side of the boat which tends to overcome the action of the centrifugal force which urges the boat outwardly.

Compared therewith, the known hydrofoil construction of the second type in which two separate hydrofoils are provided on the sides of the boat, does not produce the above described effect of righting the boat in a curve. The reason therefore is that a greater lifting force acts in a curve on the portion of each separate hydrofoil, which is located outwardly and a smaller lifting force acts on the portion of each hydrofoil which is located inwardly in the curve so that the two hydrofoils produce the substantially parallel resulting lifting forces passing, respectively, above and below the center of gravity of the craft, and compensating each other so as to produce no stabilizing effect.

It is one object of the present invention to overcome the disadvantages of the above described hydrofoil constructions according to the prior art, and to provide a hydrofoil arrangement which achieves great stability of the craft in curves, and has a minimum resistance during high speed straight movement of the craft.

It is another object of the present invention to provide

on a water craft two hydrofoil means which may be arranged underneath the forward or rearward portion of the craft and exert a stabilizing effect when the craft passes through a curve.

It is a further object of the present invention to provide a hydrofoil arrangement including two hydrofoil means arranged on both sides of the hull of a craft in a plane transverse to the longitudinal axis of the craft, and being so shaped that the hydrofoil means which is located outwardly in a curve produces a lifting force which tends to stabilize and aids in righting the craft in opposition to the action of the centrifugal force while the craft passes through a curve.

It is still a further object of the present invention to provide hydrofoils of such shape that only a small portion of the hydrofoil is submerged in the water whereby unnecessary resistance is avoided.

With these objects in view, the present invention mainly consists in a hydrofoil arrangement which comprises two hydrofoil means adapted to be arranged on both sides of the longitudinal plane of symmetry of a craft, each of the hydrofoil means including a hydrofoil element upwardly inclined in outward direction with respect to the plane of symmetry, and supporting means adapted to be secured to the craft and supporting the hydrofoil elements.

A preferred embodiment of the present invention mainly comprises two hydrofoil means adapted to be arranged on both sides of the longitudinal plane of symmetry of a craft and being located in a plane transverse to the longitudinal plane of symmetry, each of the hydrofoil means including a substantially vertical supporting element adapted to be arranged outwardly spaced from the plane of symmetry and having a lower end, and an upper end adapted to be secured to the craft, the supporting element being bounded by two arcuate convex surfaces; and a foil element upwardly inclined in outward direction with respect to the plane of symmetry and being connected to the lower end of the supporting element, the foil element being bounded by an arcuate convex surface and by a straight surface.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a side view of a craft provided with hydrofoils according to the present invention;

Fig. 2 is a front view of the craft shown in Fig. 1;

Fig. 3 is a cross-sectional view taken on line 3—3 in Fig. 2;

Fig. 4 is a cross-sectional view taken on line 4—4 in Fig. 2;

Fig. 5 is a cross-sectional view taken on line 5—5 in Fig. 2;

Fig. 6 is a front view of one embodiment of the present invention;

Fig. 7 is a front view of another embodiment of the present invention;

Fig. 8 is a front view of a modified embodiment of the present invention; and

Fig. 9 is a front view of another modified embodiment of the present invention.

Referring now to the drawings, and more particularly to Figs. 1 and 2, a craft 1, such as a speed boat, is provided with a forwardly located hydrofoil means 2 and with a rearwardly located hydrofoil means 2'. Anyone of the hydrofoil means 2 and 2' may be constructed according to the present invention, and the other of the two hydrofoil means 2 and 2' may be of the same, or of a

different construction. In the following description, the forwardly located hydrofoil means 2 will be described.

As best seen in Fig. 2, the forwardly located hydrofoil means 2 comprise two hydrofoil means 2, 2*a* which are located on both sides of the longitudinal axis of symmetry of the craft. The hydrofoil means 2 and 2*a* are constructed in the same manner, each hydrofoil comprising a vertical supporting element or portion 4 and a supporting member 5. The supporting member 5 is fixedly connected to the hull of the boat and to the upper end of the foil portion 4. The foil portion 4 is preferably rigidly connected to the supporting portion 3 by an arcuate portion 6, as shown in Fig. 2. According to another embodiment of the present invention, shown in Fig. 6, the foil portion 4*a* is straight and extends at an acute angle with respect to the supporting portion 3. In the embodiment of Fig. 7, the foil portion 4*b* is arcuate and projects from the supporting portion 3 substantially perpendicular thereto.

According to the modified embodiments of the present invention illustrated in Figs. 8 and 9, a horizontal foil portion 7 and 8, respectively, is provided on each hydrofoil means. In the embodiment of Fig. 8, the horizontal foil portion extends at a right angle to the supporting portion 3 and defines an obtuse angle with the straight foil portion 4*c*. In the embodiment of Fig. 9, the horizontal hydrofoil portion 8 projects inwardly from the supporting portion 3 of each hydrofoil and constitutes an extension of the arcuate foil portion 4*b*. It will be understood that an inwardly projecting horizontal foil portion 8 may also be provided in the construction illustrated in Fig. 6, and that a horizontal foil portion 7 may be combined with the construction of Fig. 7 in which the foil portion 4*b* is arcuate. The horizontal foil portions 7 and 8, respectively, increase the lifting force, and are advantageously provided when the lifting force of the hydrofoil means illustrated in Figs. 2–7 is insufficient.

Fig. 3 illustrates a cross-sectional view the shape of the supporting element 3, which is preferably bounded by two convex surfaces so as to offer minimum resistance, and so as to produce no lifting force. The foil portion 4 is shown in cross section in Fig. 4. One surface 4′ of the foil portion is convex, while the other surface 4″ is straight.

Fig. 5 is a cross section through one of the supporting members 5 which is shown to have an arcuate surface 5′, a straight surface 5″ and means 5‴ reinforcing the structure. Each supporting member 5 is secured by suitable means, such as rivets, to the foil element 4 and supports the same.

As compared with the prior art, the hydrofoils according to the present invention include a supporting element or portion 3 which is constructed and arranged in such manner as to produce no lifting force. When a craft provided with the hydrofoils of the present invention passes through a curve, the effective incidence angles on the outside of the curve and on the inside of the curve are different and produce a substantially greater lifting force on the outside of the curve than on the inside of the curve so that a stabilizing force 9 is created, see Fig. 6, which tends to overcome the centrifugal force. The force 9 passes through the longitudinal plane of symmetry of the craft above the center of gravity 10 and produces a stabilizing torque.

The longitudinal and transverse stability of the craft during straight motion of the craft is obtained by the foil portions 4 which pass through the water surface when the hull is raised above the water level. When the craft moves out of its desired position, additional portions of the foil portions 4 are immersed and righten the craft, and the so called surface-effect is utilized in a known manner for stabilizing the craft.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of hydrofoils differing from the types described above.

While the invention has been illustrated and described as embodied in a hydrofoil means including two separate hydrofoils, each hydrofoil having a substantially vertical supporting portion and outwardly and upwardly extending inclined foil portion, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A hydrofoil arrangement for a craft comprising, in combination, two hydrofoil means located in a plane transverse to the longitudinal plane of symmetry of the craft underneath the forward portion of the craft, each of said hydrofoil means including a substantially vertical supporting portion downwardly depending from said craft and a single foil portion extending from the lower end of the respective supporting portion in upward and outward direction and being shaped in such manner as to produce a hydrodynamic lifting force whereby said foil portions produce in a curve a righting moment on the craft, said vertical supporting portions being located opposite each other equally spaced from the longitudinal plane of symmetry of the craft and separated from each other by a free space, each of said supporting portions having a cross-section symmetrical with respect to a plane parallel to the longitudinal axis of the craft so that said supporting portions produce no hydroynamic lifting force in a curve; and means connecting the outer ends of said foil portions, respectively, with said craft and adapted to be located above the water line.

2. A hydrofoil arrangement for a craft comprising, in combination, two hydrofoil means located in a plane transverse to the longitudinal plane of symmetry of the craft underneath the forward portion of the craft, each of said hydrofoil means including a substantially vertical supporting portion downwardly depending from said craft and a single foil portion extending from the lower end of the respective supporting portion in upward and outward direction and being shaped in such manner as to produce a hydrodynamic lifting force whereby said foil portions produce in a curve a righting moment on the craft, each of said foil portions including a horizontal foil portion located adjacent said supporting portion, said vertical supporting portions being located opposite each other equally spaced from the longitudinal plane of symmetry of the craft and separated from each other by a free space, each of said supporting portions having a cross-section symmetrical with respect to a plane parallel to the longitudinal axis of the craft so that said supporting portions produce no hydrodynamic lifting force in a curve; and means connecting the outer ends of said foil portions, respectively, with said craft and adapted to be located above the water line.

3. A hydrofoil arrangement as set forth in claim 2 wherein said horizontal portions respectively extend in inward direction from said supporting portions.

4. A hydrofoil arrangement as set forth in claim 2 wherein said horizontal portions are located outwardly of said supporting portions.

5. A hydrofoil arrangement as set forth in claim 2 wherein said supporting portions have arcuate convex symmetrical faces.

6. A hydrofoil arrangement as set forth in claim 5

wherein each of said hydrofoil portions has an outer straight face and an inner convex arcuate face.

References Cited in the file of this patent

UNITED STATES PATENTS

1,187,268	Crocco	June 13, 1916
2,081,868	Hampden	May 25, 1937
2,257,406	Von Burtenbach	Sept. 30, 1941
2,597,048	Almquist	May 20, 1952

FOREIGN PATENTS

129,628	Sweden	Oct. 3, 1950
715,558	France	Sept. 28, 1931
841,675	France	Feb. 13, 1939
851,374	France	Oct. 2, 1939