

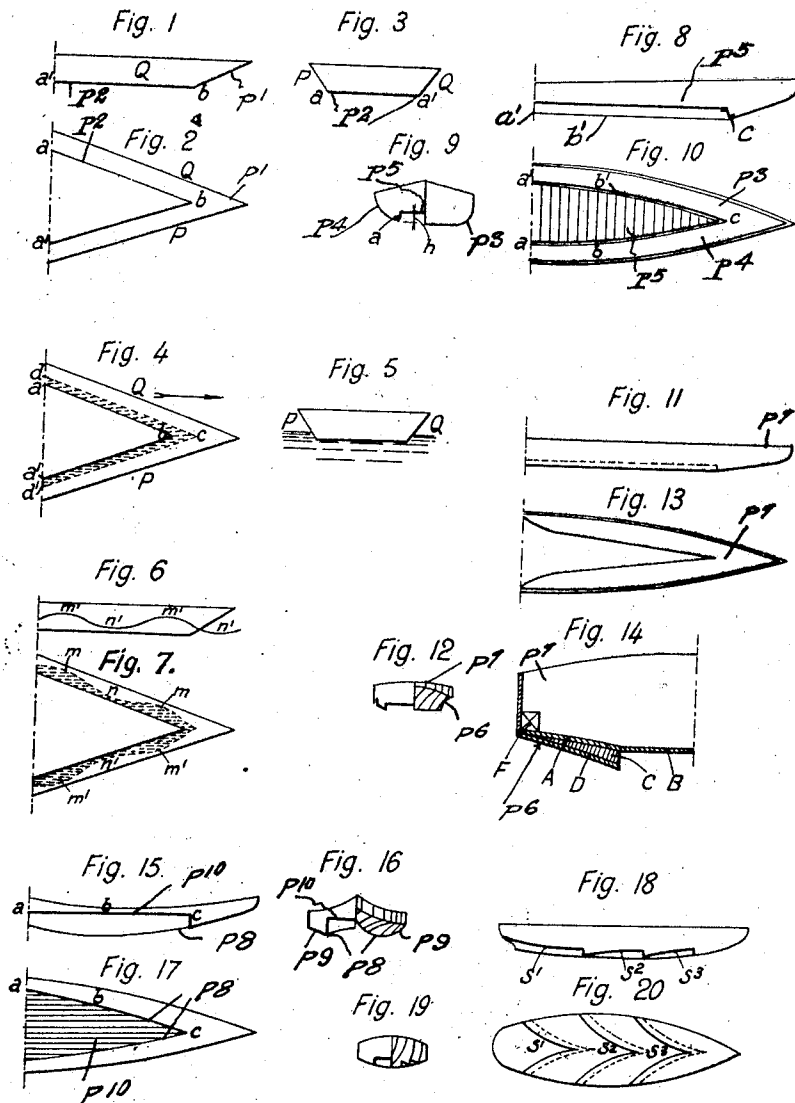
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SHIP'S HULL

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SHIP'S HULL.

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The present invention has for its object improvements in the hulls of ships of the glider and hydro-plane type, which permit, in contradistinction to hulls heretofore proposed, construction of sea-going ships capable of sailing at all speeds and possessing the qualities of speed which are generally considered as the characteristics of the type of ship heretofore referred to as gliders and hydro-planes. In gliders of certain types, spaced inclined sustaining surfaces are disposed one behind the other and connected by means of stepped surfaces. During motion, when the rear portions of the sustaining surfaces are only slightly moistened by the water, the forward moistened portions of the surfaces may vary almost instantaneously in the proportion of 1 to 10, when the ship encounters a wave created by the passage of the boat through the water. The pressure of the water on the inclined surfaces being proportional to the area of the ship's wall in contact with the water, sudden variations of the surface coming in contact with the water are accompanied by sudden variations of the thrust localized at the forward sustaining surfaces of the apparatus, that is to say, at a point forward of the hull proper. Lifting of the glider (which is sudden and regular on calm water) is therefore obtained on disturbed or rough water only by means of repeated shocks always at the same place on the sustaining surfaces, and these shocks are stronger and more violent the greater the dimensions of the apparatus. On account of this, all comfort for passengers is destroyed, and the installations on board the ship, as well as the ship itself, are damaged. Finally, the localization of the thrust at successive points spaced apart from one another, determined in the hull of a glider, cause bending moments or stresses which increase rapidly with the weight and dimensions of the apparatus and render impossible the construction of gliders of large dimensions.

All these prior constructions present at low speeds a resistance which is generally greater than that which corresponds to the maximum speed, by reason of the difficulty with which the water escapes laterally when the ship is partly immersed, such effect being produced at all speeds lower than the maximum speed. This increase of resistance, due to the blunt form of the front of

the vessel, is inherent due to the disposition of the surfaces in the form of successive transverse planes; an arrangement which does not permit shaping the front of the vessel along stream lines. It follows therefrom that all increase of load or accidental weakness of the motor, causes a considerable loss in speed without a corresponding decrease in the driving power expended. The glider, such as it exists, and in spite of the modifications and improvements to which it has been subjected with a view of obviating these inconveniences, can be used only in calm water at full speed, thus requiring a perfect condition of the motor and an absence of all overload.

The shape of the sustaining surfaces, forming the subject matter of the present invention, is such that they may be progressively and totally immersed, and the hull rests on the water throughout its length and not at isolated points. The hull possesses surfaces designed to direct the water laterally without abnormal resistance when its speed is reduced from any cause whatsoever and it is then partly immersed. Finally, the thrust that it receives by reason of the lifting force produced between the hull and the water is not intermittent. It is a force which affects successively all points of the hull as in the ordinary form of ship. These results are obtained by the use of upwardly and rearwardly diverging sustaining surfaces disposed symmetrically on both sides of the longitudinal axis of the hull, and these surfaces may be of any suitable form, so long as they follow a general V-shape in plan. They can be formed of planes or wings attached to the hull or such surface may constitute wholly or in part the bottom or the walls of the ship.

The invention will now be described in detail in connection with the accompanying drawing in which:

Fig. 1 is a diagrammatic side view of the front portion of sustaining surfaces arranged in accordance with my invention.

Fig. 2 is a bottom plan view of the same.

Fig. 3 is a cross section of the same.

Fig. 4 is a view similar to Fig. 2, but illustrating the action of the water on the surfaces when they are partly immersed in the water.

Fig. 5 is a view similar to Fig. 3 with the surfaces immersed in the water.

Fig. 6 is a view similar to Fig. 1 illustrating the action of rough water on the sustaining surfaces.

Fig. 7 is a plan view corresponding to Fig. 6.

Fig. 8 is a longitudinal vertical sectional view illustrating the application of these sustaining surfaces to a boat hull.

Fig. 9 is a front view of the same partly in vertical transverse cross section.

Fig. 10 is a plan view of the same.

In Figs. 8, 9 and 10 the sustaining surfaces form part of the hull of the boat.

Fig. 11 is a side view of the front portion of a hull to which the improved sustaining surfaces are attached.

Fig. 12 is a front view partly in transverse section of the same.

Fig. 13 is a plan view of the same.

Fig. 14 is an enlarged transverse vertical sectional view of a portion of the same.

Fig. 15 is a longitudinal vertical sectional view of a hull shaped particularly for use with hydro-planes, this hull being provided with the improved sustentation surfaces.

Fig. 16 is a front view partly in vertical transverse section.

Fig. 17 is a bottom plan view.

Fig. 18 is a longitudinal vertical sectional view of a hull having three sets of the improved sustentation surfaces arranged in successive order.

Fig. 19 is a front view partly in transverse section of the same.

Fig. 20 is a bottom plan view.

Figs. 1, 2 and 3 show the arrangement which is characteristic of the sustaining surfaces, and which for simplicity are illustrated in the figures as being formed of two planes P and Q that diverge upwardly and rearwardly. The intersection of these planes is situated in the vertical plane of symmetry of the boat as shown at P', and these planes are also inclined on both sides of the symmetrical plane. They are limited in front by the intersection forming a bow or by the intersection with any suitable connecting surface at their upper parts only. These surfaces are connected rearwardly by a line of any suitable contour to insure gliding action. At their lower portions, the surfaces are limited by their intersection with their horizontal plane, which is as close as possible to the horizontal plane of the surface of the water when the apparatus is in motion at its greatest speed. The plane limiting the lower ends of the surfaces is indicated at P². This plane and the plane of the water surface strictly coincide for a theoretically infinite speed. When this apparently cumbersome arrangement is actuated at a finite speed in the direction of the arrow, Fig. 4, the planes P, Q are partially immersed.

The water encountered by this arrange-

ment of planes escapes partly under the lower edges of the planes. Another part is deviated under the action of the planes and escapes along the latter. The resistance which opposes the advance of this latter part of the water, decreases as the angle, formed by the intersections *a*, *b*, *a'* of the planes Q, P with the horizontal plane which limit them, decreases. The part of the water which passes under the planes P and Q and escapes at the edges *a*, *b*, *a'*, undergoes by reason of this fact, a deviation which develops pressures on the wetted parts of the surfaces shown by the hatched lines between *a*, *b*, *a'* and *d*, *c*, *d'*. These pressures cause vertical lifting of the apparatus and effect the sustentation of the apparatus. The hull proper is therefore lifted from the water, from the front to the rear by the planes P Q which are uniform throughout their length in this instance.

The water which causes the lifting movement escapes freely into the triangle arranged between the lower edges of the planes, thus avoiding all contact of the sustaining surfaces with any water which, being in movement, has lost a part of its inertia and consequently its sustaining power.

When the speed is low, the thrust of the water on the surface is slight and the apparatus becomes further immersed by reason of its weight. The immersion of the planes P and Q causes the quantity of water discharged laterally to increase. By reason of the acuteness of the angle *a*, *b*, *a'* which encloses the horizontals of the planes P and Q, the aforesaid water is easily deflected and the apparatus experiences from this only a normal resistance. It acts therefore at low speeds as an ordinary ship. When the speed increases, the thrust of the water increases, the boat is lifted and the immersion and consequently the water discharged laterally, decreases. On the contrary, the proportion of water which flows under the planes, and affects lifting, increases. When the speed is sufficient, the lifting is such that the portion immersed is reduced to a very narrow band along the edges *a*, *b*, *a'*.

Referring now to Fig. 5, it may be seen that if a boat hull is arranged at the upper edges of the planes P and Q, and the boat is moving with such speed that the water is contacting with the lower portions only of the sustaining surfaces, the hull will be entirely lifted from the water and there is no surface immersed like that in gliders having the bottom of the hull in the form of a V. The apparatus therefore acts as an ordinary boat at low speed and as a perfect glider at high speed. It participates in both actions at intermediate speeds.

When the apparatus is moving on rough water, the surface of the water is obviously undulated instead of smooth. The surface

in contact with the water, when the latter is calm, as shown in Fig. 4, thereby becomes undulated as shown in Figs. 6 and 7. In these figures m, m' indicate the crests of the waves and n, n' the depressions between the waves. In its movement, the apparatus successively presents all points of the planes P and Q from the front to the rear thereof, either to the crests of the waves or to the depressions between the same alternately. It is therefore in the same condition as an ordinary boat which receives at the crests of the waves, a thrust stronger but gradually increasing as the crests of the waves approach or extend to the points under consideration. At the points m, m' where the width shown in dotted lines, which represent the immersion, is greatest, the part of the water directed laterally is greater than at the points n, n' where the immersion is less. This directing of the water to the left or to the right, can, by reason of the shape of the form of the hull, be obtained with slight resistance as in ordinary ships. This form of hull possesses, therefore, all the qualities of speed of a glider in calm water and eliminates the defects thereof because it possesses on rough water and at low speeds, the nautical qualities of ordinary ships. In practice the planes P, Q can be replaced by any suitable surfaces and may form part of a ship's hull.

Figs. 8, 9 and 10 show, by way of example, the hull of a glider formed in accordance with the principles hereinbefore described. In this example, the sustaining surfaces P^3 and P^4 form a part of the hull. As best shown in Fig. 9, the surfaces of these planes at their lower parts are convexed and at their upper parts are substantially vertical, in order to form the sides of the hull. The lower edges of these planes are shown at a', b', c, b, a to form a so-called "arched keel." This keel has at its upper part a fluid-tight floor P^5 forming the bottom of the hull. This floor is raised a height equal to h so that the water which escapes under the lower edges of the sustaining surfaces cannot come in contact with said floor. The purpose of this floor is to ensure the floatation of the apparatus when the boat is brought to rest and to support the passengers and the several installations on board the ship, but it will be understood that when the ship is in motion, the floor will actually be raised above the water surface, so that the planes P^3 and P^4 form the only sustaining means.

Figs. 11 to 14 inclusive show a second example in accordance with the invention. In this case, the sustaining surfaces are concaved as shown at P^6 and these sustaining planes are connected to the hull P^7 by angle irons or the like. The details are best shown

in Fig. 14 and in this figure A and B indicates the floor of the hull, which forms the bottom of the glider and is provided with two members C of triangular section to which the sustaining planes D are connected. Angle pieces F are arranged at the joints between the bottom and the side of the ship.

Figs. 15, 16 and 17 illustrate a hull especially adapted for hydro-aeroplanes or sea-planes. In this instance, the horizontal plane which limits the surfaces at their lower portions, is replaced by a curved line raised at the front and rear in such manner as to facilitate starting from and landing on the water. This curved line coincides with the curved edges P^8 at the lower edges of the sustaining planes P^9 . The floor P^{10} which fills the triangular space a, b, c , between the planes, is also raised so that no matter what the longitudinal inclination of the apparatus may be, the water cannot touch the said floor when the apparatus is in motion on the surface of the water. It will be seen in this example that the surfaces which in the preceding examples were either of straight or plain curves, are here curves inscribed on a circle.

Figs. 18, 19 and 20 illustrate a glider of larger dimensions. In this embodiment three inclined surfaces, similar to the planes P and Q, are placed behind each other. This arrangement is possible in this instance because the length of the hull permits the provision, between two successive surfaces, of sufficient space to admit the water which has been discharged under the foremost planes, to resume its place or its position and its relative immobility in the fluid medium. Here again it will be observed that the forces are continually distributed from the front to the rear.

The thrust on certain surfaces or planes can be decreased or increased as desired by increasing or diminishing their angularity relatively to the other surfaces or planes. Thus as shown in Figs. 18 to 20 inclusive, it will be seen that the surface s^2 is lower than the surfaces s' and s^3 , so as to increase the vertical thrust at the center of the ship and to diminish it at the ends.

In the construction shown in Figs. 11 to 20 inclusive, the surfaces of the planes may be undulated if desired.

What I claim and desire to secure by Letters-Patent is:

1. A boat hull, the sides of said hull being inclined inwardly and rearwardly toward its bottom, the bottom of said hull being substantially triangular in form and elevated above the lowermost portion of said sides, the apex of the bottom being adjacent the bow of the boat.

2. A boat hull as claimed in claim 1, the

sides of said hull being substantially plane surfaces.

3. A boat hull, the bottom of said hull being formed from a series of planes, the forward portion of each of said planes being elevated above the rear and side portions thereof, each plane being V-shaped and having an acute angled apex.

4. A boat hull as claimed in claim 3, the

apex of the forwardmost plane being adjacent the bow of the boat. ad- 10

5. A boat hull as claimed in claim 3, the middle portion of the plane intermediate the bow and stern of the boat being lower than the middle portions of the planes adjacent the bow and stern of the boat. ad- 15

In testimony whereof I affix my signature.

PAUL BONNEMAISON.