

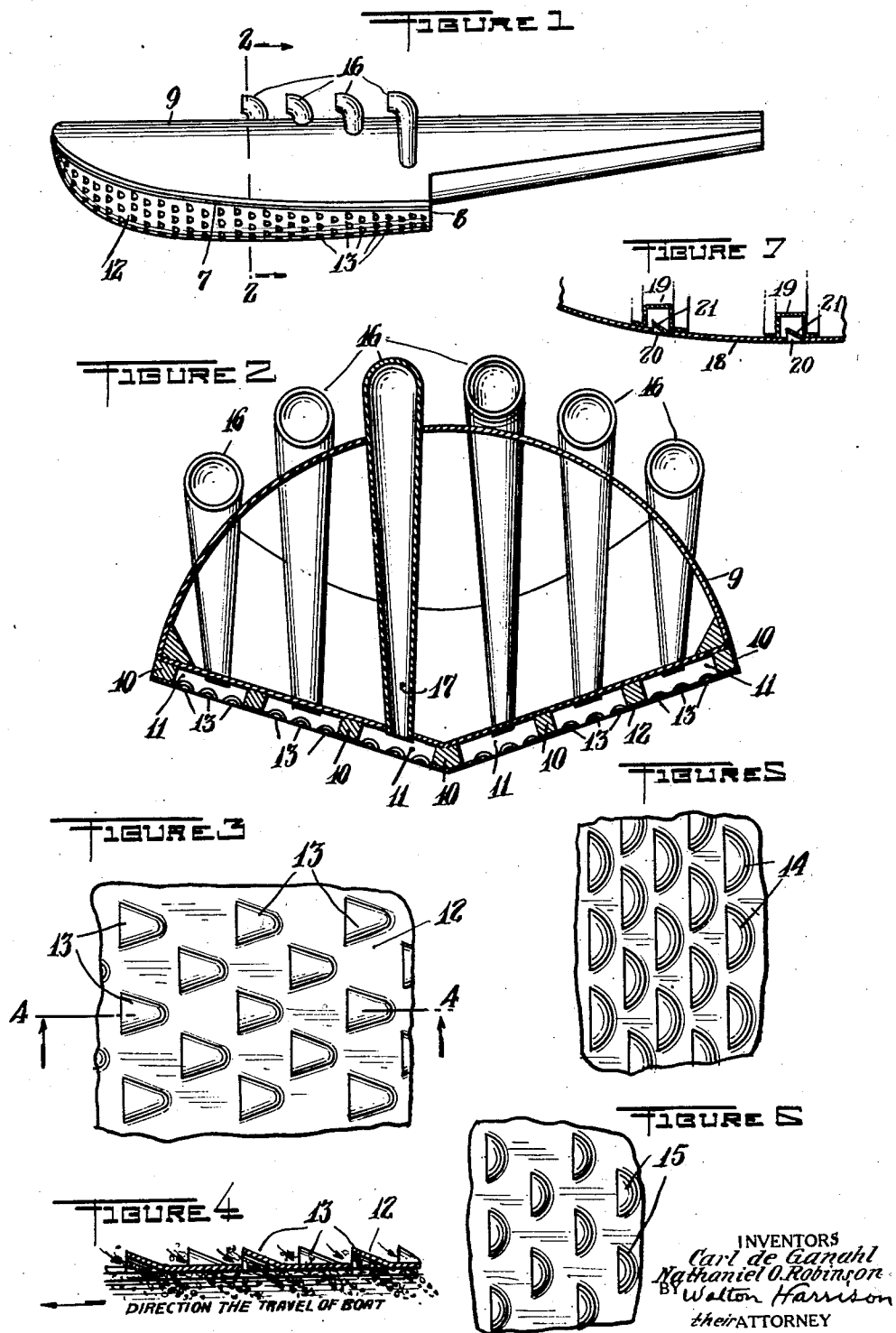
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BOAT HULL AND METHOD OF REDUCING THE WATER FRICTION THEREUPON

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BOAT HULL AND METHOD OF REDUCING THE WATER FRICTION THEREUPON

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Our invention relates to high speed boat hulls, and methods of reducing the water friction thereupon.

More particularly stated, our invention relates to the use of air for the reduction of water friction upon the bottom of a boat hull traveling at very high speed.

Our invention is well adapted for use upon seaplanes and all similar craft such as are required to rise from the water, our invention enabling them to encounter less resistance in leaving the water than would ordinarily be the case.

It is a fact generally known in this art that when a surface which is flat or substantially flat, such for instance as a boat bottom, is in contact with water through which it passes at a very high speed, a suction is developed between the flat surface and the water; that is, a reduction in static pressure due to velocity head.

In practice the velocity head indicates a reduction in static pressure of the order of fifty pounds per square inch, with a boat traveling at speed approximately sixty miles per hour.

This high reduction pressure can be explained by Bernoulli's theorem which states when a fluid is flowing the pressure is inversely proportional to the velocity. When a vessel passes over water at very high speed the pressure on the bottom is inversely proportional to the velocity, and a consequent high suction is developed.

This has been established in speed trials of a number of very fast boats in the early days, when in some instances boat bottoms were very materially loosened, and in one or two extreme cases were literally pulled out from under the stern of the vessel.

The invention of the hydroplane brought about a considerable reduction of this suction pressure, the improvement being due to the introduction of one or more steps into the hull of the vessel, in such manner as to permit the entrance of air behind the steps, thus greatly reducing the area of the unwetted surface of the hull, the air being admitted freely where the suction had been greatest.

Our invention is essentially a further improvement on the general types of construction here under consideration; and in some instances will eliminate all necessity for using one or more steps.

Briefly stated, we seek to provide the hull of a high speed vessel, including the forward portion of the hull or so much of this forward portion as is normally under water while the boat is in action, with a tough and durable skin of sheet metal, spaced about one or two inches outwardly and away from the hull, and held firmly in place by suitable stringers fastened to the hull, and to which the skin of sheet metal is directly secured.

This skin of sheet metal serves as a false bottom. Between it and the hull of the vessel are lengthy air compartments. We provide means for supplying air freely into these air compartments, and the suction, due to the travel of the boat through the water, constantly aspirates or siphons air from these compartments, through openings formed in the false bottom adapted for this purpose.

We seek further to provide a simple and efficient form and arrangement of air outlet openings through the bottom of the hull.

Reference is made to the accompanying drawing forming a part of this specification, and in which like reference characters indicate like parts throughout the several figures.

Figure 1 is a side elevation of a high speed boat hull provided with our invention, the means for propelling the vessel not being shown.

Figure 2 is a section on the line 2—2 of Figure 1, looking in the direction indicated by the arrows.

Figure 3 is a detail view, showing in elevation a portion of the false bottom.

Figure 4 is a section on the line 4—4 of Figure 3, looking in the direction indicated by the arrows.

Figure 5 is a view like Figure 3, but showing a slightly different form of air openings adapted to serve as suction nozzles.

Figure 6 is also a view somewhat like Figure 3, but showing still another form of air openings adapted for use as suction nozzles.

Figure 7 is a fragmentary section showing a boat hull provided with another form of our invention.

The hull of the vessel is shown at 7 and is provided with a step, shown at 8, and with a deck shown at 9.

These parts may be of the usual or any desired construction.

We make no effort to illustrate any means of propelling the craft, as many such means are old and well-known, these forming no part of our invention.

Mounted firmly upon the hull 7 are a number of stringers 10, spaced apart preferably in stream line formation, as shown.

Between the stringers 10 are lengthy air spaces 11, which by following the contour of the stringers and the curvature of the hull, are also disposed in stream line formation.

Mounted firmly upon the stringers 10 is the outer hull 12, made preferably of tough and durable sheet metal. Stainless steel is good for this purpose, but other metals may be used as required.

The outer hull 12 is perforated; that is, formed with openings, made by slitting through the metal and bending or pressing portions 13 thereof slightly inward as shown, each portion having in this instance the form of a conic section, and in all instances being bent concavely inward from the general plane of the outer hull.

In Figures 5 and 6 we show these portions at 14 and 15, having slightly different forms than those just described. Such forms may be multiplied without limit, the main essential being that they should be of such configuration as to continuously set up suction as the boat travels through the water.

The principle is illustrated in Figure 4. The direction in which the boat is moving is indicated by the arrow shown at the left, and by the legend Direction the travel of boat, and the direction of movement of air is indicated by the small arrows at the air outlet openings.

In order to supply air freely and in large quantities into the air compartments 11, we provide air pipes 16, connected with the hull 12 and extending therefrom upwardly through the deck 9. Each of these air pipes provides an air passage 17, extending from the free atmospheric air above the deck of the vessel into some one of the air passages 11.

With the boat standing still in the water, there is of course a sheet of water completely covering all such portions of the hull as are submerged beneath the surface.

When, however, the boat is in motion, in the direction to the left according to Figures 1 and 4, a change takes place. As the speed of the boat accelerates there is set up, around each of the portions 13, a very strong suction. This is due to the velocity of the boat as

above described. Therefore air is drawn down through the passages 17 into the compartments 11. Any water contained in these passages and compartments is quickly discharged through the openings formed by the portions 13. The compartments 11 fill with air, which now passes freely through them and is discharged in the form of bubbles, as may be understood from Figure 4.

These bubbles are so numerous and their supply so profuse and constant that the outer hull of the vessel is virtually passing through a sea of foam, there being practically a thin layer of air between the outer hull and the body of water through which the vessel now moves.

The several air outlet openings are spaced apart both longitudinally and transversely of the hull and are so staggered with respect to each other transversely of the hull that incoming air is distributed substantially uniformly throughout the whole transverse width of the submerged part of the hull.

In instances where the boat leaves the water, it does so without any material drag due to friction of the water or to suction between the water and the bottom of the boat.

Thus the skin friction of the water on the wetted surface of the hull, if not entirely eliminated, is reduced almost to zero, brought about by the natural suction inherently developed by the rapid forward travel of the boat through the water.

In the form of our invention shown in Figure 7 we use only a single hull, shown at 18. Secured to the inner surface of this hull are hollow members 19, made preferably of sheet metal. These are fitted in position airtight and watertight. They are quite strong, and serve the double purpose of air ducts and cross frames. They lead upwardly following the slope of the hull, to the open air.

The hull 18 is provided with openings 20, made by cutting slots through the hull, and bending portions 21, 21 of the hull inwardly, as above described with reference to the outer hull.

As the boat moves rapidly over the water as above described, air is entrained and drawn downwardly and out through the openings 20, 20, into the water, thus relieving the negative pressure inherent between the water and the hull when the boat is traveling at high speed. The film of air or air foam or bubbles, constantly maintained, acts also as a lubricant as between the hull and the water, all in the same manner as above pointed out with regard to the structure Figures 1 to 6.

Where the boat has a stepped bottom, our invention acts as an auxiliary to this stepped bottom, and greatly reduces the resistance ordinarily offered by a boat of this type.

While our invention is applicable to boats of many different types and thus admits of

general use, it is specially adapted for use upon seaplanes and amphibians and as used therewith is of the utmost importance.

This is because in a seaplane or amphibian the ordinary suction effect or dragging of the water upon the hull, and especially at the critical moment when the hull is in the act of leaving the water, is very great, due to high velocity; and our invention, by relieving this great suction, enables the seaplane or amphibian to take off more quickly and with less power and greater safety than has heretofore been the case.

We do not limit ourselves to the precise construction here illustrated and described, as variations may be made therein without departing from our invention, the scope of which is commensurate with our claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is as follows:

1. In a boat hull, seaplane hull or float the combination of a main bottom and a false bottom located below the main bottom and spaced therefrom, said false bottom being provided with perforations so located and arranged that whenever a suction is developed between the false bottom and the water this suction draws air through the said perforations, thus breaking the suction, inwardly turned conical portions on said false bottom projecting from one edge of the perforations to a point inwardly of but spaced above an opposite edge so as to leave an opening between said second edge and said conical portion, the base of the conical portion facing the direction of travel of the boat, and means whereby a supply of air may reach the space between the false bottom and the main bottom.

2. In a boat hull, seaplane hull or float the combination of a main bottom and a false bottom located below the main bottom and spaced therefrom, said false bottom being provided with perforations so located and arranged that whenever a suction is developed between the false bottom and the water, air is drawn through the said perforations, thus breaking the suction, inwardly turned conical portions on said false bottom projecting from one edge of the perforations to a point inwardly of but spaced above an opposite edge so as to leave an opening between said second edge and said conical portion, the base of the conical portion facing the direction of travel of the boat, and vents extending upwardly through the main bottom in order to supply air into the space between the main bottom and the false bottom.

3. In a boat or the like, a hull having a plurality of perforations in the bottom thereof, inwardly projecting conical portions on said bottom extending from one edge of the perforations to a point inwardly of an oppo-

site edge, the base of the conical portion facing the direction of travel of the boat and being open, means forming a series of compartments into which the inwardly projecting portions project, and pipes leading to said compartments through which air may be drawn and emitted beneath said inwardly projecting portions and through said perforations when the hull is traveling through water.

4. In a boat hull or the like, the combination of a bottom and strengthening cross frames, said bottom being provided with perforations, inwardly projecting conical portions on said bottom extending from one edge of the perforations to a point inwardly of an opposite edge, the base of said conical portion facing the direction of travel of the boat and being open, and said cross frames being constructed to provide passage-ways for a supply of air to said perforations.

5. In a boat or the like, a hull which when driven rapidly through the water tends to develop a high vacuum between its bottom and the water, said hull having a multitude of perforations through the bottom thereof, the material of said bottom being formed to provide at each perforation a portion of the bottom extending upwardly and rearwardly from one edge of the perforation to a point spaced upwardly above an opposite edge of the perforation, means forming a series of compartments into each of which a plurality of the upwardly extending portions project, and said compartments having means through which air may freely enter said compartment for passage through said perforations beneath said upwardly extending portions.

6. In a boat or the like, a hull which when driven rapidly through the water tends to develop a high vacuum between its bottom and the water, said hull having its bottom made of a sheet of material formed with a multitude of slits therethrough each extending lengthwise in a direction transverse to the length of the hull, the material of the sheet adjacent to and forward of each slit being undisturbed so that its bottom surface lies in the common plane of the bottom surface of the main part of the sheet, but the material of the sheet adjacent to and rearward of each slit being bent inwardly of the hull so as to provide a rearwardly facing air outlet opening between itself and the forward edge of the slit and so as to provide a downwardly and rearwardly inclined portion of the sheet continuing rearwardly from said air outlet opening to the common plane of the bottom surface of the main part of the sheet.

7. In a boat or the like, a hull which when driven rapidly through the water tends to develop a high vacuum between its bottom and the water, said hull having its bottom made of a sheet of material formed with a multitude of slits therethrough each extend-

ing lengthwise in a direction transverse to the length of the hull, the material of the sheet adjacent to and forward of each slit being undisturbed so that its bottom surface lies in the common plane of the bottom surface of the main part of the sheet, but the material of the sheet adjacent to and rearward of each slit being bent inwardly of the hull so as to provide a rearwardly facing air outlet opening between itself and the forward edge of the slit and so as to provide a downwardly and rearwardly inclined portion of the sheet continuing rearwardly from said air outlet opening to the common plane of the bottom surface of the main part of the sheet, and said slits and hence said air outlet openings being distributed about said hull so that they stand spaced apart both lengthwise and transversely of the hull and so that transversely of the hull they are staggered with respect to each other whereby collectively to supply air uniformly to substantially the entire transverse width of the submerged portion of the hull.

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