May 5, 1936. G. G. EDDY ET AL 2,039,585

PLANING BOAT

Filed May 23, 1935 2 Sheets-Sheet 1

Fig. 1.

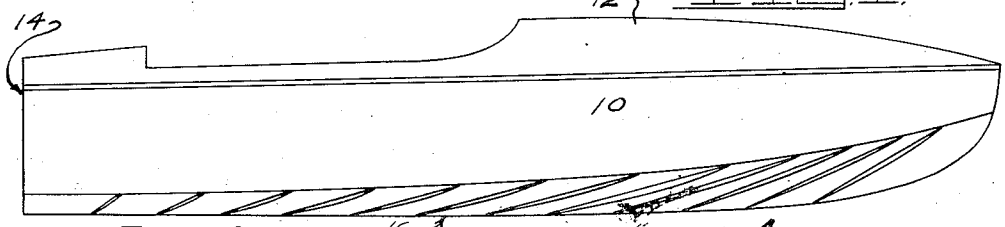


Fig. 2.

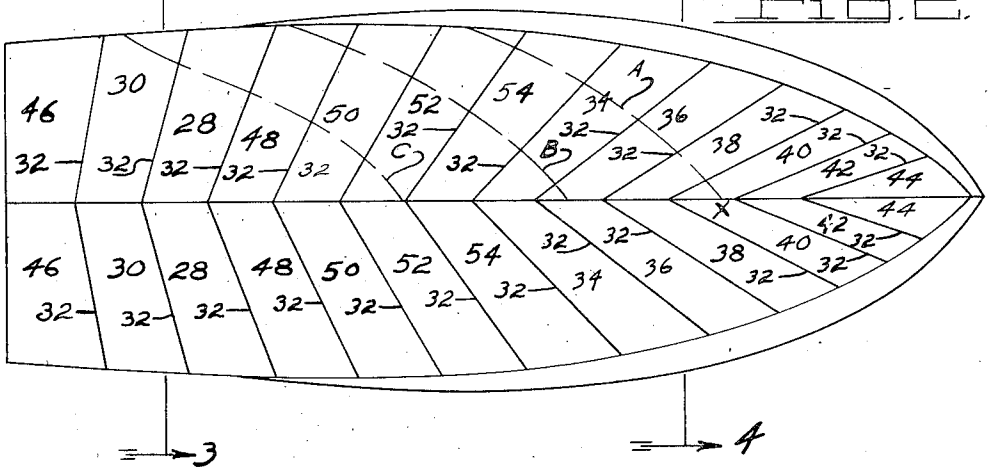


Fig. 3.

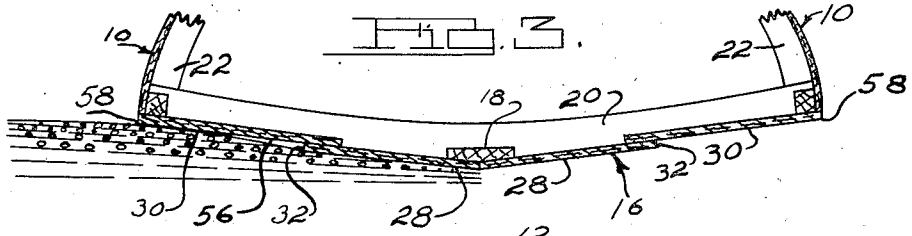
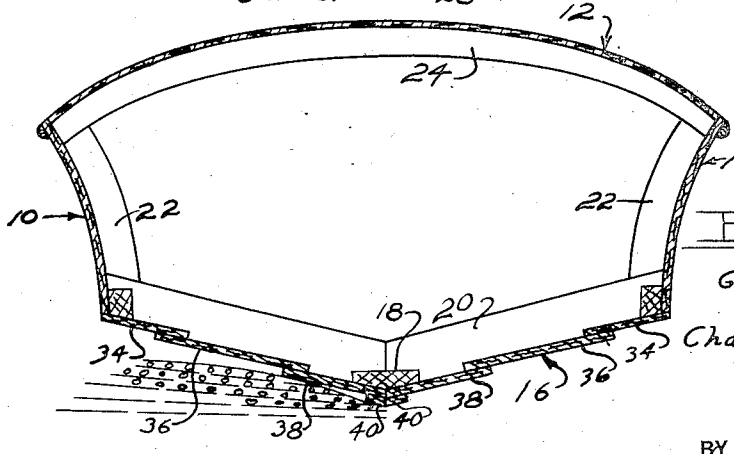


Fig. 4.



George G. Eddy
And
Charles Douglas Van Patten
INVENTORS

BY Harness, Dickey, Pierce & Mann
ATTORNEYS.

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Fig. 5.

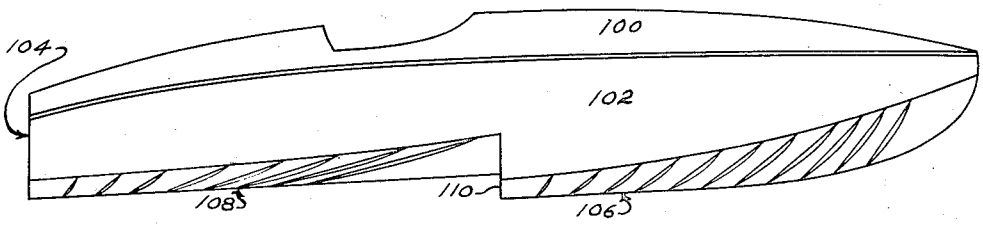


Fig. 6.

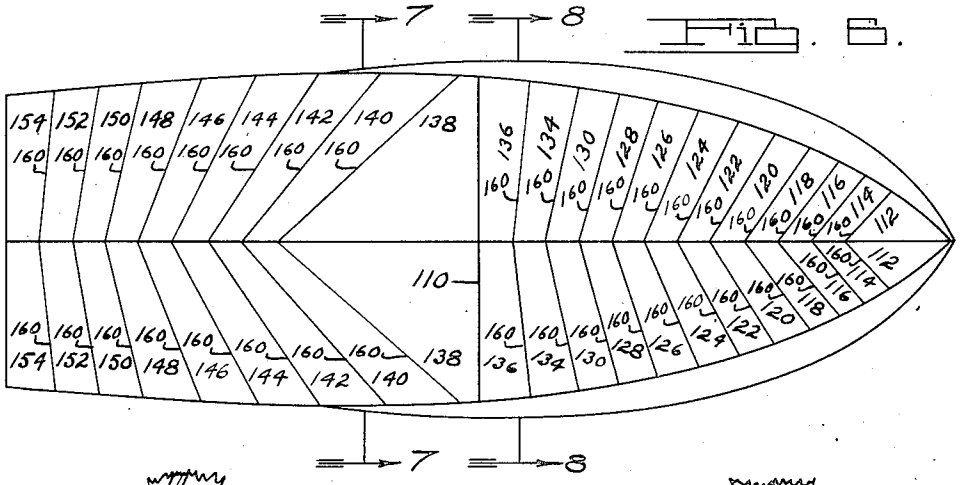


Fig. 7.

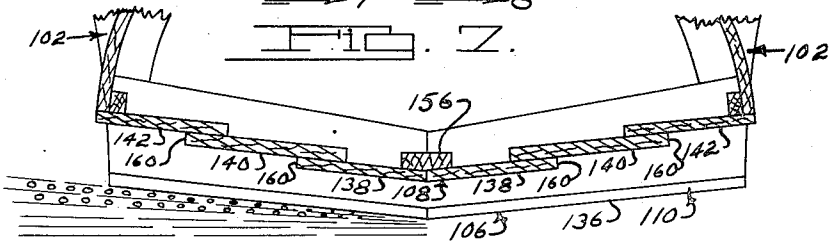
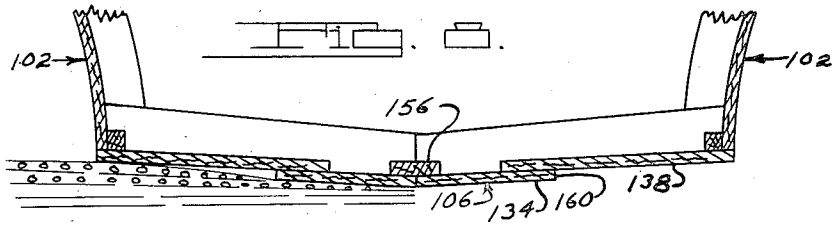


Fig. 8.



George G. Eddy
And
Charles Douglas Van Patten

INVENTORS

BY Harness, Dickey, Pierce & Hum

ATTORNEYS

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UNITED STATES PATENT OFFICE

2,039,585

PLANING BOAT

George G. Eddy, Manistee, and Charles Douglas Van Patten, Flint, Mich.; said Van Patten assignor to said Eddy

Application May 23, 1935, Serial No. 22,976

21 Claims. (Cl. 114—66.5)

This invention relates to boats and seaplane pontoons of the type having a planing or hydrodynamic lifting reaction in the water when at speed, the principal object being the provision of a new and novel type of planing or lifting surfaces for boats of such types which include what are commonly known as V bottom boats and hydroplanes.

An object of the invention is to provide a novel form of planing or lifting surfaces for a boat of the type described by the use of which the area of wetted surface is considerably reduced, as compared to conventional constructions, during movement of the boat over and through the water.

Another object is the provision of a planing surface or surfaces for a boat of the class described by the use of which the entrance wave is prevented from coming in contact with the greater portion of those surfaces which it is not actually reacting against to produce lift.

Another object is to provide a planing surface construction for boats and the like so constructed as to utilize whatever hydrodynamic lifting effort is required, and no more.

Another object is to provide a planing surface or surfaces for a boat which will so condition the water over and through which the boat passes as to reduce the surface frictional resistance of the boat to forward movement.

Another object is to provide a planing surface or surfaces by the use of which the water disturbance or wave-making resistance is considerably reduced, as compared to conventional constructions, during movement of the boat over and through the water.

Another object is to provide a planing surface or surfaces for a boat in which the tendency to compress the water against the planing surfaces or any part contiguous thereto during its movement outwardly from the keel is largely eliminated.

Another object is the provision of a planing surface or surfaces the use of which largely eliminates the adhesion of water to the bottom of the boat and the consequent abnormal raising of the entrance wave, thereby permitting the use of more efficient and more seaworthy shapes than are possible in conventional constructions.

Another object is to provide a planing surface or surfaces so constructed as to considerably reduce the air resistance of the boat to forward movement by permitting a part of the air that would normally be forced aside to pass under the boat.

Another object is to provide a novel form of planing surfaces for a hydroplane of the stepped type so constructed as to greatly reduce the disadvantages present in conventional constructions due to the formation of a low pressure region immediately back of such step or steps.

Another object is to provide a planing surface or surfaces for a boat of the class described having special provision for reducing the area in contact with the water in accordance with the weight and speed of the boat without impairing the lateral stability of the boat either in turning or moving in a straight line.

Another object is the provision of a boat planing surface or surfaces so constructed as to materially increase the directional stability over that obtained with conventional constructions.

Another object is to provide a planing surface or surfaces for a boat of the class described by the use of which the longitudinal stability is increased, as compared with conventional constructions, without increasing the area of wetted surface over that required for most efficient planing of the boat.

Another object is to provide a planing surface or surfaces for a boat of the class described so constructed as to convey air to those regions of the bottom normally in contact with the water, and such that the water in having a relative lateral flow with respect to such surface or surfaces will draw such air with it and will cause it to be intimately mixed therewith during movement of the boat over and through the water.

Another object is the provision of a boat of the class described in which a series of diagonally, upwardly and rearwardly extending stepped or jogged surfaces are provided in the bottom thereof.

Another object is the provision of a boat of the class described having a planing surface or surfaces of the above described type in which the diagonally extending steps or jogs on opposite sides of the keel extend in converging angles towards the stern of the boat.

Another object is to provide a boat of the class described having a planing surface or surfaces of the above described type in which each diagonally extending jog is no greater in depth than a distance equal to twenty per cent of the width of the wider proximate planing surface.

Another object is the provision of a boat of the class described having a planing surface or surfaces formed of a plurality of relatively narrow planing surfaces extending diagonally of the hull, each of the latter planing surfaces being

vertically displaced from the adjoining ones in an upward direction laterally from the keel and longitudinally from the bow whereby to form a jog between each of said latter surfaces and which surfaces may be conveniently provided by suitably lapping the bottom planks of the hull.

Another object is to provide a boat of the class described having a planing surface or surfaces of the above described type so formed as to have the diagonal jogs varying in depth from zero at either or both ends to the maximum at their central portions.

Another object is to provide a boat of the class described having a planing surface or surfaces of the above described type so formed as to have the jogs approximately at right angles to the relative flow of water under all portions of the wetted area of the bottom.

The above being among the objects of the present invention, the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

In the accompanying drawings which illustrate suitable embodiments of the present invention and in which like numerals refer to like parts throughout the several different views:

Figure 1 is a side elevational view of a planing or semi-planing type of boat, commonly known as a V bottom boat, in which a suitable embodiment of the present invention is incorporated.

Fig. 2 is a bottom view of the boat shown in Fig. 1.

Fig. 3 is an enlarged transverse sectional view of the boat shown in Figs. 1 and 2, taken on the line 3—3 of Fig. 2.

Fig. 4 is an enlarged transverse sectional view of the boat shown in the previous figures taken on the line 4—4 of Fig. 2.

Fig. 5 is a side elevational view of a boat of the single step hydroplane type embodying the present invention.

Fig. 6 is a bottom view of the boat shown in Fig. 5.

Fig. 7 is an enlarged transverse sectional view of the boat shown in the previous two figures taken on the line 7—7 of Fig. 6.

Fig. 8 is an enlarged transverse sectional view of the boat shown in the previous three figures taken on the line 8—8 of Fig. 6.

Ideally, a boat having a bottom consisting of one or more flat or nearly flat planing or lifting surfaces, when propelled at speed on the water, would move over the surface of the water rather than through it. Due, however, to the facts that water is a fluid, that the boat has mass or weight, that surface friction occurs between the wetted surface of the boat and the water, and that therefore there is a tendency to displace water, ideal planing never actually occurs. The proximity to which ideal planing is approached is dependent upon the relationship which exists between the mass of the boat, the speed, and the hydrodynamic reaction characteristics of the planing surface or surfaces of the boat.

It is also true in practically all constructions that an entrance wave is created at the line or point where the entering edge first impinges upon the water. This wave is deflected by the force of forward movement of the boat hull in a generally outward, upward and rearward direction in relation to the hull. This wave, therefore, comes in contact with the planing surface or surfaces and in conventional constructions remains in continuous contact with the planing surface to the outer edges of the same. For purposes of analysis, the lift or planing effort created by the entrance wave can be considered as an adjunct to that created by certain of the other hydrodynamic reaction phenomena related to the planing surface or surfaces and the forward movement of the boat. It is our theory that this wave factor is of great importance in the action of planing boat surfaces on and in the water, because the outward, upward and rearward movement of the water contained therein not only produces lift, which is a planing aid, but also because it produces increased wetted area due to its adhesion to the planing surfaces and consequently increased resistance to forward movement.

Among the principal objects of the present invention are the elimination of the greater part of that portion of the wetted area due to the adhesion and the consequent abnormal raising of the entrance wave, increase of the effective lifting or planing effort created by the entrance wave, and substantial reduction of that portion of the remaining wetted area not producing an effective planing or lifting effort. In other words, one theory of our invention is to so form the planing surfaces as to utilize whatever hydrodynamic lifting effort is required to maintain the boat at the most efficient point of planing, and no more, and to eliminate as far as possible any contact of the hull with the water not directly utilized for lifting purposes.

Specifically, the manner in which we have accomplished this result is to form each major lifting or planing surface of a multiplicity of smaller planing surfaces terminating at their forward and outer ends at the bilge and at their rearward ends at the keel, and whose greatest dimensions lie in diagonal directions with respect to the length of the boat and in complementary converging relationship toward the stern on opposite sides of the boat, each of the latter planing surfaces being vertically displaced from the adjoining ones in an upward direction laterally from the keel and longitudinally from the bow, thereby forming a jog between each of the latter surfaces. To achieve such a construction in lightly built boats it will often be most practical to taper the depth of the diagonal jogs from the maximum at their central portions to zero at either or both ends thereby eliminating the necessity for notches in either the keel or the bilge frame members where such members may be too light for such notches.

The action of such a construction in the water is considerably different from that of constructions heretofore proposed. Upon impinging at the keel or entering edge and being deflected in a relatively outward, upward and rearward direction, the water, by its own inertia, is freed of contact with the planing surface of the boat at the point or points where these jogs occur, which greatly reduces the area of wetted surface and therefore the resistance of the boat to forward movement.

With such construction at certain speeds and on certain portions of the bottom the deflected water will leave the jog and flow relatively outwardly and rearwardly again coming in contact with the next laterally outward or longitudinally rearward planing surface and, leaving this latter planing surface, flow outwardly and rearwardly again coming in contact with the next outward or rearward planing surface, this action continu-

ing until the water has passed the outer extremities of the boat or by its own inertia takes a course not in contiguity with the surface of the boat.

In the ordinary type of stepped hydroplane construction as conventionally practiced, the forward motion of the boat creates a region of reduced atmospheric pressure back of the step or steps and the transom or stern. This low pressure region, in attempting to relieve itself, draws both air and water into the space behind such step or steps or stern, and tends to draw the surface water up into contact with the bottom of the boat, thereby creating resistance to forward movement to a much greater degree than would occur were this low pressure eliminated. The present invention is of material advantage in this respect as the diagonal jogs in combination with the rearward movement of the water and air relative thereto as above explained induces a considerable amount of air that would ordinarily be forced aside to pass under the boat thereby relieving to a great extent the region of low pressure that would ordinarily exist back of such step or steps or stern.

Referring now to the drawings and particularly to Figs. 1 to 4 inclusive, it will be noted that we have shown in these figures a boat of the planing or semi-planing type having a single major planing area, the particular type of boat shown being what is commonly known as a V bottom boat. In the usual construction of this type of boat the bottom portions of the bow sections are usually arranged in V formation and generally flatten out as they approach the stern section which is usually approximately flat or at least is a very flat V. The boat shown in Figs. 1 to 4 inclusive is of this general type in that its lower surfaces in the bow sections are arranged in generally V relation and the stern sections are more nearly flat. The boat shown includes sides 10, deck 12, stern 14, and bottom indicated generally as at 16. As indicated in Figs. 3 and 4 the boat is preferably provided with a keel 18 or equivalent structure and ribs or frame members 20, 22 and 24 of a suitable nature. Each side of the bottom 16 on opposite sides of the keel 18 is identical to the other side except reversed in position and both sides are symmetrically arranged with respect to the keel and to a vertical plane passing through the keel longitudinally thereof. Each half of the bottom surface 16 on opposite sides of the keel 18 is formed of a plurality of smaller planing surfaces 28, 30, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, each of which extends diagonally of the boat and is separated from the next adjacent planing surface by an upward jog 32, the vertical surfaces of such jogs facing rearwardly and intersecting the keel 18 at their rearward ends.

In the drawings, in accordance with our preferred embodiment of the present invention, it will be noted that the diagonal jogs 32 intersect the keel 18 at angles increasing successively toward the stern.

It is to be noted that the diagonal jogs 32 are of a material depth and which depth may, in actual practice, be equal to the thickness of the bottom planks which form the planing surfaces 28, 30, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, and 54, and the utilization of which bottom planks thereby offers a simple and ready means for effecting the desired result. It has been found, however, that the maximum depth of the jogs 32 should not be greater than twenty per cent of the width of the corresponding planing surface measured in a direction perpendicular to the length of the jogs, and that where such jogs vary in depth as illustrated in the drawings from zero at their ends to a maximum depth at or near their mid-point of length, the distance from the point of maximum depth to the points where they fade out should not exceed one hundred times the maximum depth of the jogs for best operating conditions.

From the operation of the above described boat and referring particularly to Fig. 2, let it be assumed that with the boat at speed the water will first impinge upon the boat at a point on the keel such as X. The impingement of the water on the boat at this point will cause what is commonly known as an entrance wave to be created and which entrance wave will be deflected and have a relative flow along lines such as A, B, and C rearwardly, outwardly and upwardly with respect to the bottom of the boat. In conventional constructions this entrance wave, which necessarily spreads as it moves relatively rearwardly, outwardly and upwardly, will remain in contact with the bottom of the boat for the full width of the wave and for the full distance from the keel to the outer edge of the bilge, even when such edge is well above the normal surface of the water over and through which the boat is passing. The reason for this occurrence in conventional constructions is that the bottom of the boat is a smooth unbroken surface and the adhesion of water to such a surface carries the water on up the bottom until it is finally freed at the outer edge of the bilge.

Now in accordance with the present invention when incorporated in a boat of the type shown in Figs. 1 to 4 inclusive, when the boat attains its speed the bow section will tend to lift and the boat will tend to have a planing action on the water. Accordingly, due to the fact that the water has an upward, outward and rearward movement relative to the bottom of the boat, there will be a reaction between the bottom of the boat and the water such as is illustrated on the left hand side of Fig. 3.

Referring to Fig. 3 it will be noted that due to the outward, upward and rearward movement of the water relative to the bottom of the boat, and particularly when the boat is at speed, the water in passing outwardly, upwardly and rearwardly over the rearward edge of the surface 28 will not strike the surface 30 until it reaches a point thereon materially spaced from the diagonal jog 32 separating these two surfaces, and consequently will leave a portion such as 56 of the area of surface 30 free of contact with the water. The size of the area 56 will depend upon the vertical dimension of the jog 32, the degree of V in the bottom of the boat, and the weight, breadth and speed of the boat.

This water having a relative outward, upward, and rearward flow with respect to the bottom of the boat will then flow outwardly, upwardly and rearwardly over the surface 30 until it reaches the bilge 58 or the next rearward jog 32 separating the surface 30 from the surface 46 at which point it will break away from the surface 30 and will come in contact with the surface 46 at a point thereon spaced from the jog 32 between the surfaces 30 and 46 thus leaving another area similar to 56 free of contact with the water.

This action will continue as the water flows outwardly, upwardly and rearwardly relative to the bottom of the boat until the water reaches the outer edge of the bottom or until the water reaches such point or area of the bottom which, at the particular moment, is located above the

normal surface of the water over and through which the boat is moving. In Fig. 4 as a matter of illustration of this last point, it is considered that the surfaces **34** and **36** are located above the level of the surface of the water in which case the water, after it leaves the surface **38**, because of the fact that it is no longer under the direct displacing effect of the boat, will flow directly outwardly and rearwardly without coming in contact with the surfaces **34** and **36** and consequently will not wet such surfaces or burden them with its resistance. Consequently, in the condition assumed in Fig. 4, the only wetted portion of the bottom of the boat in the section which this figure represents will include only the surface **40** and a part of the surface **38**, and the wetted area of the bottom of the boat will consequently be materially reduced over the corresponding wetted area of boats having bottoms of conventional construction.

It may here be noted that area **56** previously referred to which is not in contact with the relatively moving water under the boat when the boat is at speed will continue to exist over the greater part of the length of each diagonal planing surface througnout the entire length of water contact area of the boat bottom. The maintenance of such areas as **56** is materially aided in the particular construction illustrated due to the fact that the jogs **32** intersect the keel **18** at angles increasing successively toward the stern **14** thereby maintaining the jogs substantially at right angles to the relative flow of water under the bottom of the boat.

An important result of the construction provided by the present invention is that the jogs **32**, which are open to the atmosphere at least in the bow portion of the bottom of the boat, are constantly containing air over the greater part of their lengths when the boat is at speed, and the water in having a relative flow substantially at right angles to the jogs **32** constantly picks up a part of such air in the form of small bubbles which are intimately mixed with a boundary layer of water in contact with the boat bottom. Due to the fact that this boundary layer passes over successive jogs **32** in flowing outwardly, upwardly and rearwardly, larger and larger amounts of air are picked up by the water until it reaches an outer edge of the boat bottom or such point where it loses contact therewith. At the same time it will be apparent that the boundary layer of water which flows relatively under the stern **14** will have a material amount of air mixed therewith.

The result of this action is that the boat moves substantially over and through a layer of water containing air in bubble form which offers less resistance than water of a normal consistency. It is our theory that this presence of an aerated layer of water for the boat to ride on is one of the reasons why a boat built in accordance with the present invention is capable of attaining a greater speed than when built in accordance with conventional constructions, power and load being equal.

Referring now to another important result of the construction provided by the present invention, the elimination of the greater part of the burdening effects of water adhesion makes possible the use of distinctly convex shapes in the bottom portions of the bow sections resulting in easier riding and materially increased seaworthiness over that obtained with boats having bottoms of conventional construction.

Referring now to Figs. 5 to 8 inclusive of the drawings, it will be noted that in these figures a planing or semi-planing type of boat is illustrated of the single step type, that is a boat having a single transverse step. The boat shown includes deck **100**, sides **102**, stern **104**, and a bottom including two major planing surfaces indicated generally as at **106** and **108** separated from each other by a transverse step **110**. Each of the major planing surfaces **106** and **108** closely follows the general construction of the entire bottom **16** of the boat described in connection with Figs. 1 to 4 inclusive. In other words the bow portion **106** is formed of a series of smaller planing surfaces **112** to **136** inclusive symmetrically arranged in complementary relation on opposite sides of the keel **156** and extending diagonally of the boat, each of such planing surfaces being separated from the next adjacent planing surface by an upward jog **160**, the vertical surfaces of such jogs facing rearwardly and intersecting the keel **156** at their rearward ends.

Similarly the bottom portion **108** is formed of a series of smaller planing surfaces **138** to **154** inclusive symmetrically arranged in complementary relation on opposite sides of the keel **156** and extending diagonally of the boat, each of such planing surfaces being separated from the next adjacent planing surface by an upward jog **160**, the vertical surfaces of such jogs facing rearwardly and intersecting the keel **156** at their rearward ends.

In the drawings, in accordance with our preferred embodiment of the present invention, it will be noted that the diagonal jogs **160** intersect the keel **156** at angles increasing successively toward the stern.

It is to be noted that the diagonal jogs **160** are of a material depth and which depth may, in actual practice, be equal to the thickness of the bottom planks which form the planing surfaces **112** to **154** inclusive and the utilization of which bottom planks thereby offers a simple and ready means for effecting the desired result.

In general the bottom of this boat in passing over and through the water effects the same results as in the construction previously described in connection with Figs. 1 to 4, inclusive, in that the water has a relative flow rearwardly, upwardly and outwardly with respect to the keel, and because of this relative movement it loses contact with the bottom of the boat at each diagonal jog **160**, thus producing an area free of contact with the water similar to **56** as illustrated in Fig. 3.

Likewise the jogs **160** which are open to the atmosphere, at least at their outer ends, are constantly containing air over the greater part of their lengths when the boat is at speed, and the water in having a relative flow substantially at right angles to the jogs **160** constantly picks up a part of such air in the form of small bubbles which are mixed with a boundary layer of water to provide an aerated blanket of water for the boat to ride on.

In this type of boat as previously mentioned, the reaction of the boat with the water when at speed tends to create a region of reduced atmospheric pressure immediately to the rear of the transverse step **110**, and this reduced pressure in attempting to relieve itself tends to force the water up into contact with the rearward bottom portion **108** at a point much closer to the transverse step **110** than would otherwise be the case, the result of such tendency when unchecked being to increase the water adhesion effect and the wetted

area of the boat bottom and correspondingly decrease its speed. Where the bottom of the boat is constructed in accordance with the present invention sufficient of the air induced in the diagonal jogs 160 is carried rearwardly along the bottom portion 106 to the region back of the transverse step 110 to largely eliminate the low atmospheric pressure at this point, thereby greatly reducing the detrimental effects which would otherwise exist in considerable degree.

Although but two specific examples of the present invention have been shown in connection with the drawings, it will be apparent that the teachings herein will be sufficient to permit one skilled in the art to adapt the inventive thought to like devices of different types of construction, and accordingly it is to be understood that formal changes may be made in the specific embodiments of the invention described without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

We claim:

1. A boat of the planing or semi-planing type having substantially the entire bottom surface thereof comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

2. A boat of the planing or semi-planing type having substantially the entire bottom surface thereof comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

3. A boat of the planing or semi-planing type having substantially the entire bottom surface thereof comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog not greater in depth than a distance equal to twenty percent of the width of said planing surface, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

4. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed comprised of a multiplicity of diagonally extending separate planing surfaces extending continuously in a direction opposed to the keel of said boat and toward the bow of said boat from the said keel, each of said planing surfaces having a complementary planing surface on the opposite side of said keel, each of said planing surfaces being substantially flat in transverse section and separated from the next adjacent planing surface by a relatively sharp jog not greater in depth than a distance equal to twenty percent of the width of said planing surface, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

5. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of diagonally extending planks intersecting the keel of said boat, each plank on each side of said keel within the major width of said boat overlapping the next adjacent plank toward said keel and toward the bow of said boat and being overlapped by the next adjacent plank away from said keel and from said bow whereby to form a sharp approximately vertical jog upwardly at the outer edge of each of said planks, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

6. A boat of the planing or semi-planing type having substantially the entire bottom surface thereof comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog decreasing in depth to zero at its rearward termination from a point removed on its length therefrom by a distance equal to not more than one hundred times its greatest depth, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

7. A boat of the planing or semi-planing type having substantially the entire bottom surface thereof comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog not greater in maximum depth than a distance equal to twenty percent of the width of said planing surface, each of said jogs decreasing in depth to zero at its rearward termination from a point removed on its length therefrom by a distance equal to not more than one hundred times its greatest depth, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

8. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog decreasing in depth to zero at its forward termination from a point removed on its length therefrom by a distance equal to not more than one hundred times its greatest depth, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

9. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog not greater in maximum depth than a distance equal to twenty percent of the width of said planing surface, each of said jogs decreasing in depth to zero at its forward termination from a point removed on its length therefrom by a distance equal to not more than one hundred times its greatest depth, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

10. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog, each of said jogs varying in depth from zero at its ends to the maximum at its central portion, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

11. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog not greater in maximum depth than a distance equal to twenty percent of the width of said planing surface, each of said jogs varying in depth from zero at its ends to the maximum at its central portion, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each said jog with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow over the greater portion of the length of the boat.

12. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a plurality of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each jog in at least one of said planing areas with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the

stern toward the bow, over the greater portion of the length of the corresponding planing area.

13. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a multiplicity of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog not greater in maximum depth than a distance equal to twenty percent of the width of said planing surface, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each jog in at least one of said planing areas with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow, over the greater portion of the length of the corresponding planing area.

14. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a multiplicity of diagonally extending separate planing surfaces extending continuously in a direction opposed to the keel of said boat and toward the bow of said boat from said keel, each of said planing surfaces having a complementary planing surface on the opposite side of said keel, each of said planing surfaces being substantially flat in transverse section and separated from the next adjacent planing surface by a relatively sharp jog not greater in maximum depth than a distance equal to twenty percent of the width of said planing surface, the vertical surfaces of said jogs facing rearwardly, and the distance of the point of junction of each jog in at least one of said planing areas with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow, over the greater portion of the length of the corresponding planing area.

15. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a multiplicity of diagonally extending planks intersecting the keel of said boat, each plank on each side of said keel within the major width of each of said major planing areas overlapping the next adjacent plank toward said keel and toward the bow of said boat and being overlapped by the next adjacent plank away from said keel and said bow whereby to form a relatively sharp approximately vertical jog upwardly at the outer edge of each of said planks, and a distance of the point of junction of each jog in at least one of said planing areas with the keel from the point of junction of said each said jog with the bilge, measured in a direction parallel to the keel of the boat, increasing in the direction of from the stern toward the bow, over the greater portion of the length of the corresponding planing area.

16. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a multiplicity of diagonally distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog decreasing in depth to zero at its rearward termination from a point removed on its length therefrom by a distance equal to not more than one hundred times its maximum depth, the vertical surfaces of said jogs facing rearwardly and intersecting said keel at angles increasing successively toward the rearward end of the corresponding major planing area.

17. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a multiplicity of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog not greater in maximum depth than a distance equal to twenty percent of the width of said planing surface, each of said jogs decreasing in depth to zero at its rearward termination from a point removed on its length therefrom by a distance equal to not more than one hundred times its maximum depth, the vertical surfaces of said jogs facing rearwardly and intersecting said keel at angles increasing successively toward the rearward end of the corresponding major planing area.

18. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a multiplicity of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog decreasing in depth to zero at its forward termination from a point removed on its length therefrom by a distance equal to not more than one hundred times its maximum depth, the vertical surfaces of said jogs facing rearwardly and intersecting said keel at angles increasing successively toward the rear-

ward end of the corresponding major planing area.

19. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a multiplicity of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog not greater in maximum depth than a distance equal to twenty percent of the width of said planing surface, each of said jogs decreasing in depth to zero at its forward termination from a point removed on its length therefrom by a distance equal to not more than one hundred times its maximum depth, the vertical surfaces of said jogs facing rearwardly and intersecting said keel at angles increasing successively toward the rearward end of the corresponding major planing area.

20. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a multiplicity of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog, each of said jogs varying in depth from zero at its ends to the maximum at its central portion, the vertical surfaces of said jogs facing rearwardly and intersecting said keel at angles increasing successively toward the rearward end of the corresponding major planing area.

21. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous contact with the water when at speed formed of a plurality of longitudinally separate major planing areas, each of said major planing areas comprised of a multiplicity of diagonally extending distinct planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being substantially flat in transverse section, each of said planing surfaces terminating at its forward end at the bilge of said boat and at its rearward end at the said keel, each of said planing surfaces being separated from the next adjacent planing surface by a relatively sharp jog not greater in maximum depth than a distance equal to twenty percent of the width of said planing surface, each of said jogs varying in depth from zero at its ends to the maximum at its central portion, the vertical surfaces of said jogs facing rearwardly and intersecting said keel at angles increasing successively toward the rearward end of the corresponding major planing area.

GEORGE G. EDDY.
CHARLES DOUGLAS VAN PATTEN.