

Nov. 21, 1933.

G. G. EDDY

1,935,622

PLANING BOAT

Filed Dec. 1, 1931

2 Sheets-Sheet 1

FIG. 1.

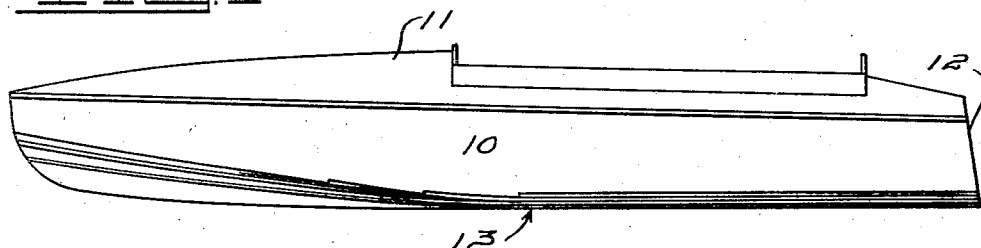
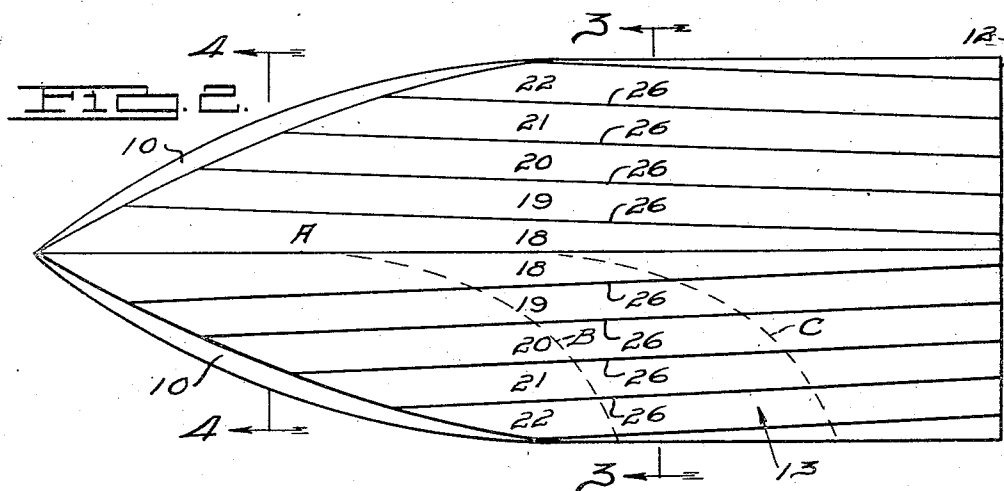
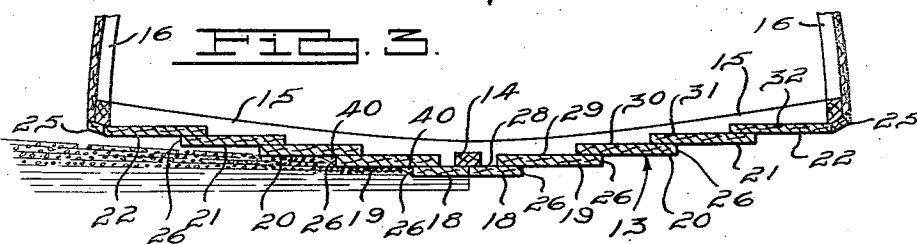
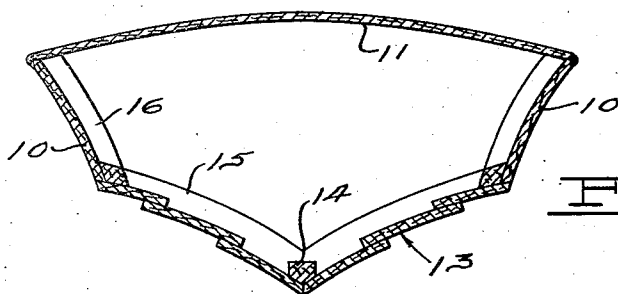


FIG. 4.

INVENTOR
George G. Eddy.

BY

James, Dickey, Paine & Horn
ATTORNEYS.

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G. G. EDDY

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2 Sheets-Sheet 2

FIG. 5.

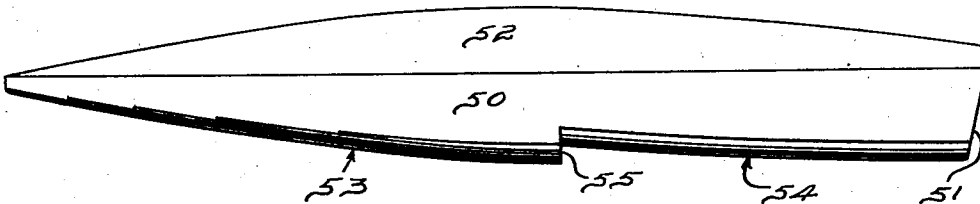


FIG. 6.

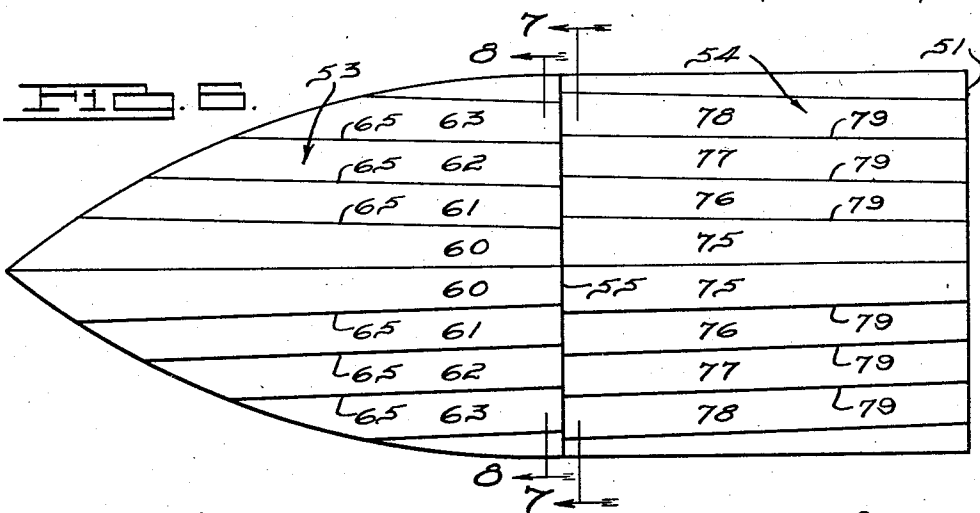


FIG. 7.

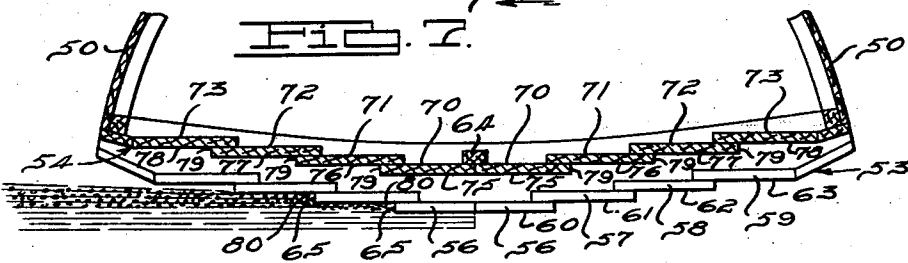
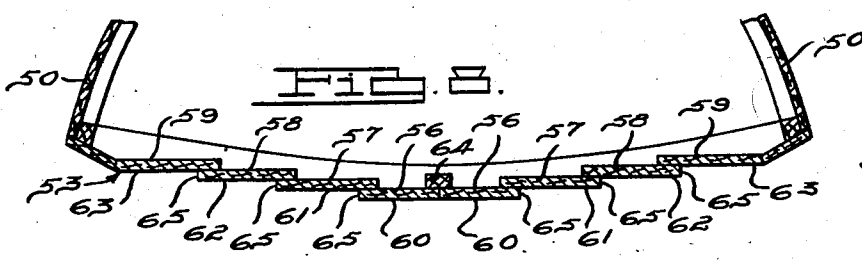


FIG. 8.



INVENTOR
George G. Eddy.

BY

Harnes, Dickey, Pierce & Hann
ATTORNEYS.

UNITED STATES PATENT OFFICE

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PLANING BOAT

George G. Eddy, Manistee, Mich.

Application December 1, 1931. Serial No. 578,319

6 Claims. (Cl. 114—56.5)

This invention relates to boats, including pontoons, and particularly to boats of the type having a semi or greater planing action on the water, the principal object being the provision of
 5 a new and novel type of planing 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 surface for a boat of the type
 10 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 the water.

Another object is the provision of a planing
 15 surface or surfaces for a boat of the class described by the use of which the entrance wave is prevented from contacting with those surfaces which it is not actually reacting against to produce an upward thrust.

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

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

Another object is to provide a planing surface
 30 for a boat by means of which air will be mingled with the water over which the boat is passing and thus provide an aerated layer of water for supporting the boat.

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

Another object is the provision of a boat planing surface so constructed as to eliminate the
 40 packing of solid water against any part of the bottom surface of the boat.

Another object is to provide a boat planing surface so constructed as to convey air to those regions of the surface normally contacting with the water, and such that the water in having a relative lateral flow with respect to such surface will draw such air with it and will cause it to be intimately mixed therewith to provide an aerated
 50 cushion of water for supporting the boat during movement through the water.

Another object is to provide a novel form of planing surface for a hydroplane of the stepped type and so constructed as to greatly eliminate
 55 the disadvantages occurring in conventional con-

structions due to the formation of a low pressure area immediately back of such step or steps.

Another object is to provide a planing surface for boats of the class described having special provision for reducing the area of water contact in
 60 accordance with the weight and speed of the boat without impairing the ability of the boat to make turns without undue danger of tipping over.

Another object is the provision of a boat of the class described in which a series of longitudinally
 65 extending outwardly and upwardly extending stepped surfaces are provided in the bottom surface thereof.

Another object is the provision of a boat of the class described having a planing surface of the
 70 above described type in which the longitudinally extending steps on opposite sides of the keel extend in generally converging relationship toward the stern end of the boat.

Another object is the provision of a boat of 75 the class described having a planing surface composed of a plurality of relatively narrow planing surfaces extending longitudinally of the hull, each of the latter planing surfaces being vertically displaced from the adjoining ones in an upward
 80 direction laterally from the keel, whereby to form a jog or step between each of said latter surfaces, and which surfaces may be conveniently provided by suitably lapping the bottom planks
 85 of the hull.

The above being among the objects of the present invention the same consists in certain features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed, having
 90 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
 95 throughout the several different views:

Fig. 1 is a side elevational view of a semi-displacement or semi-planing type of boat, commonly known as a V bottom boat, in which a suitable embodiment of the present invention is incorporated.
 100

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

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

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

Fig. 5 is a side elevational view of a boat of 110

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 a transverse sectional view of the boat shown in the previous two figures taken on the line 7-7 of Fig. 6.

Fig. 8 is a transverse sectional view taken on the line 8-8 of Fig. 6.

Theoretically a boat bottom, consisting of one or more flat or nearly flat planing surfaces, when propelled at speed on the water, would move over the surface of the water rather than through it. Due, however, to the fact that the water is not a solid, and the boat has weight and, therefore, a tendency to displace water in relation to its weight, true planing, that is, where the planing surface or surfaces pass directly on and over the true surface of the water, never actually occurs. The degree to which actual planing occurs is dependent upon the relationship between the weight and speed density of the water. In the practical application of the plane theory, including variations from a flat planing surface in the thwartship sectional design, either in a V, convex or other shape of boat bottom design, the theory is always used in an attempt to relate the displacement or weight factor to the degree of lift created by the relation of the speed and the water density factors.

It is also true that in practically all constructions an entrance wave is created at the point where the keel first impinges on the water. This wave is deflected by the force of forward movement of the boat hull outwardly, upwardly and rearwardly, as related to the direction of movement of the hull. This wave, therefore, contacts with the bottom of the planing surface or surfaces and in conventional constructions follows the contour of the hull or planing surfaces clear to the outer edges of the same. The lift or planing moment created by this wave differs considerable from the planing moment created by the displacement speed and water density factors and the true theoretical surface of the water. It is my theory that this wave factor is of greater import in the action of planing boat surfaces on and in the water, because its outward, upward and rearward action not only lifts, which is a planing aid, but because its rearward movement sets up a retarding frictional resistance that retards the speed of planing surfaces through and over the water.

It is also true that as the speed of a hydroplane increases, less and less planing surface is required to maintain a given weight of hydroplane at or near the maximum efficient planing point. I have taken advantage of this fact, in accordance with the present invention, by so designing the planing surfaces of the boat hull that as such planing surfaces approach the surface of the water, as the speed of the boat increases, the area of such planing surfaces in contact with the entrance wave (which wave is diverted throughout the bottom planing surfaces from the point of entrance rearwardly therefrom) is reduced, thereby reducing the frictional drag on the boat hull which would otherwise be present due to the greater area of wetted surface.

In other words, one theory of my invention is to so form the planing surfaces as to utilize whatever water efforts are required to maintain the boat hull at the proper planing location with respect to the surface of the water, 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 I have accomplished this result is to form each planing surface of a multiplicity of smaller planing surfaces whose greatest lengths lie in a forward and aft direction and the lowest of which surfaces are located at the keel or centerline of the boat and the highest of which surfaces are located at the widest portion of the boat or at the bilge proper. It is important that these surfaces be either substantially horizontal or else incline upwardly away from the keel for a purpose which will hereinafter be described. Furthermore, these surfaces are separated vertically from each other so as to form lateral steps or jogs at their adjacent edges and which steps or jogs extend upwardly from the outer edge of each of these smaller planing surfaces to the inner edge of the next adjacent planing surface laterally outwardly therefrom as respects the keel of the boat.

The action of such a construction in the water is considerably different than constructions heretofore proposed. Upon impinging at the keel or centerline and being deflected outwardly, upwardly and rearwardly, the water, by its own momentum, is freed from the planing surface of the boat at the point or points where these breaks, steps or jogs occur, which therefore reduces the frictional resistance of the boat planing over and through the water, by eliminating contact of the entering wave with the planing surfaces except at those points where it actually produces a material lifting force. With such construction at certain speeds the deflected water will leave the jog and flow outwardly and upwardly again contacting with the next laterally outward planing surface and, leaving the next break or jog and flow outwardly and upwardly contacting with the next outwardly located surface, this action continuing theoretically until such time as the boat plane attains sufficient speed and rises sufficiently high toward the true surface of the water, that the water is diverted with such force that it is only in contact with the first and lowest bottom planing section, which point of operation is, therefore, the theoretical maximum point of efficiency. Ordinarily, in the actual operation of the present invention, where the central sections are of relatively narrow width, the boat will seldom, if ever, ride wholly on the central section, but will ride on two or more when at speed. However, where the central planing surfaces are of a width comprising a material proportion of the width of the boat, this theoretical condition may actually be realized in practice.

In the ordinary type of stepped hydroplane construction as conventionally practiced, the forward motion of the boat plane creates a suction back of the step or steps and the transom or stern. This suction, in attempting to relieve itself draws both air and water into the space behind such step or steps or stern, creates a drag on the boat and tends to draw the surface water up into contact with the bottom of the boat, thereby creating an undesired drag, to a much greater degree than would occur were this suction eliminated. The present invention is of material advantage in this respect as the longitudinal steps or jogs above referred to, in combination with the rearward and outward action of the water relative thereto as above explained, creates a series of hollows between the boat bottom and the water, including each step or jog, and running in a fore

and aft direction. These hollows form passages between the boat bottom and the water through which air may readily flow from the forward portion of the hull to the step or steps or to the transom, as the case may be, and I have found that this largely eliminates the suction above referred to. The elimination of this suction drag is an important factor in the speed of the hull and the actual effect thereof is similar to the releasing of the brakes on an automobile.

In connection with the above described passages extending longitudinally of the boat between the bottom and the water at each jog or lateral step, another important result is obtained in connection with the present invention. In this respect it is well understood that when a conventional type of planing or semi-planing boat reaches a certain raised or lifted position and planing angle with respect to the surface of the water, while at speed, the amount of power which must be expended in increasing the speed of the boat beyond the speed at which such condition is first obtained, is considerably out of proportion, in a detrimental sense, to the power necessary to bring the boat up to such speed. The reason seems to be that the speed density of the water increases so rapidly after such point (which may be referred to as the critical point or speed) is reached, and that a corresponding increase in frictional resistance is built up between the boat bottom and the water.

I have found that if it is possible to prevent the speed density of the water from building up as fast as it commonly does in connection with conventional boat bottom designs, the ratio of increased speed to increased power beyond the critical point is raised considerably. I have also found that this may be accomplished if the water through and over which the boat is planing, contains a material amount of air in the form of small bubbles, so that the boat is actually supported on a mass of aerated water. It is not essential that more than a relatively thin layer or blanket of such aerated water contact with the wetted surfaces of the boat bottom to obtain the beneficial results of such condition.

In the construction of a boat bottom in accordance with the present invention as above described, such a layer of aerated water is produced for the hull to ride on. This layer is produced for the following reasons: When the boat is up to speed, that is, effecting a planing action on the water, air is carried rearwardly along the bottom of the hull as previously described in the pockets formed at each lateral step between the bottom of the boat and the water. Because of the displacement of the water by the boat, the water, in its relative flow towards the stern of the boat also flows outwardly, and in flowing outwardly picks up and carries with it part of the air from each of the pockets referred to. The water, in flowing over each lateral step or jog, has a more-or-less turbulent action and in picking up air from the pockets causes the air to be intimately mixed with the boundary layer of water contacting with the hull, and consequently forms a layer of aerated water for the boat to ride on. In fact, such aerated layer of water is plainly discernible by looking over the edge of a boat built in accordance with the present invention, when the boat is at speed on the water.

The production of the above described layer of aerated water is enhanced, I have found, if the longitudinal jogs or lateral steps in the plan-

ing surfaces of the boat, taper inwardly towards the keel of the boat in the direction of the bow towards the stern, or in other words, the corresponding jogs on opposite sides of the keel converge towards the stern. This convergence of the jogs or steps, however, has an additional function in the action of the hull on the water that will be more fully described. It may be noted here, however, that the amount of air which is picked up and mingled with the water to produce the aerated layer above described, does not seem to affect the use of the lateral steps or jogs in carrying a sufficient amount of air to the longitudinal step of a stepped type of hydroplane, to eliminate any suction which might otherwise be apparent back of such longitudinal step as previously discussed.

In connection with these lateral steps or longitudinal jogs in the planing surfaces of the boat hull I have further found it very important that corresponding steps or jogs on opposite sides of the keel converge gradually towards each other in the direction of the stern of the boat in order to obtain satisfactory steering qualities in the boat.

Where the longitudinal steps or jogs run longitudinally of the boat in parallelism with the keel, upon attempting to turn the boat I have found that such resistant pressures are brought to bear on the vertical surfaces of the steps or breaks as to endanger capsizing of the boat at higher speed, as such steps or jogs then function on that side of the boat on the outside of the turn in more-or-less the manner of a center-board, against which solid water tends to build up, and act to resist such turning effort. However, where such steps or jogs converge inwardly toward the keel from the bow to the stern, the water in passing over such steps or jogs always flows outwardly over the same relative to the keel and thereby eliminates any keel-like effect as above described which might otherwise be apparent. This inwardly and rearwardly convergence of the steps or jogs accordingly eliminates any resistance to the turning of the boat as well as enhances the formation of the aerated layer of water previously discussed.

Referring now to the drawings and particularly to Figs. 1 to 4 inclusive, it will be noted that I have shown in these figures a boat of the semi-displacement or semi-planing type, devoid of any transverse steps, 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 surfaces of the bow section 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 approximately flat although, as will hereinafter be more specifically pointed out, the lower surface of the stern sections in accordance with the present invention are never absolutely flat nor are they ever of a concave formation. The boat shown includes sides 10, deck 11, stern or transom 12 and a bottom indicated generally as at 13. As indicated in Figs. 3 and 4 the boat is preferably provided with a keel 14 or equivalent structure and ribs or frame members 15 and 16 of a suitable nature.

Each side of the bottom 13 on opposite sides of the keel 14 is identical to the other side ex-

cept 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

5 surface 13 on opposite sides of the keel 14 is formed of a plurality of smaller planing surfaces 18, 19, 20, 21 and 22, each of which is located in elevated relation with respect to the previous one in the order in which they extend from the
10 keel 14 to the bilge 25. Each of the surfaces 18 to 22 inclusive extends longitudinally of the boat over the full length of the corresponding increment of bottom width thereof and each of these surfaces is separated from its adjacent surface
15 by an upward step or jog 26 of a length commensurate with the corresponding surface.

In the drawings, in accordance with my preferred embodiment of the present invention, it will be noted that the longitudinal steps or jogs
20 26 on opposite sides of the keel 14 tend to converge towards each other in the direction of the stern 12.

It is to be noted that the surfaces 18 to 22 inclusive are spaced vertically from each other by
25 a material amount and which amount may, in actual practice, be equal to the thickness of the bottom planks 28 to 32 inclusive which correspond to such surfaces, and the utilization of which thereby offers a simple and ready means
30 for effecting the desired result. It is also to be noted that the plane of each of the surfaces 18 to 21 inclusive in the stern sections, if extended outwardly from the keel 14 would never intersect the plane of the next adjacent surface out-
35 wardly of the keel therefrom within the lateral confines of the hull. In other words, while the surface of each individual planing surface may, in some portions of the bottom, be substantially horizontal, and in other portions incline up-
40 wardly and outwardly away from the keel, they never incline outwardly and downwardly relative to the keel.

From the operation of the above described boat and referring particularly to Fig. 2, let it be as-
45 sumed that the boat at speed will first contact with the water at the keel at a point such as A. The contact of the boat with the water at this point will cause what is commonly known as a bow wave to be produced and this bow wave
50 will have a relative flow along lines such as B and C rearwardly, outwardly and upwardly with respect to the bottom of the boat. In conventional constructions this bow wave, which neces-
55 sarily spreads as it travels rearwardly, outwardly and upwardly, will wet 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 corresponding level of the surface of the water.
60 The reason this occurs in conventional constructions is that the bottom of the boat is flat and the adhesion of the water to the bottom of the boat carries the water on up the bottom until it is finally freed at the outer edge of the bilge.

65 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 to have a planing action on the water. Accord-
70 ingly, due to the fact that in this construction the bottom of the boat at the outer edges of the bilge is relatively higher than the bottom at the keel, there will be certain portions of the bottom where the outer edges of the bilge are above the
75 normal surface of the water over which the boat

is passing. In such a case 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
80 the outward movement of the water relative to the bottom of the boat, and particularly when the boat is at speed, the water in passing outwardly over the outer edge of the surface 18 will not
85 strike the surface 19 until it reaches a point thereon materially spaced from the longitudinal step 26 separating these two surfaces, and consequently will form a pocket such as 40 between the wa-
90 ter on the one hand and the surface 19 and the step 26 separating it from the surface 18, on the other hand. The size of the pocket 40 will, of course, depend not only upon the vertical dimen-
95 sions of the step 26 but also the speed of the boat.

This water having a relative outward flow with respect to the bottom of the boat will then flow
100 outwardly over the surface 19 until it reaches the step 26 separating the surface 19 from the surface 20, at which point the water will break away from the surface 19 and will contact with the surface
105 20 at a point thereon spaced from the step 26 between the surfaces 19 and 20 thus forming another pocket 40.

This action will continue as the water flows outwardly relative to the keel until the water
110 reaches the outer edge of the bottom, as may always occur in many cases at the stern of the boat, 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 upon which the boat is riding. In Fig. 3 as a
115 matter of illustration of this last point, it is considered that the surfaces 21 and 22 are located above the level of the surface of the surrounding water in which case the water, after it leaves the surface 20, because of the fact that it is no longer
120 under the direct displacing effect of the boat, will flow directly outwardly without contacting with the surfaces 21 and 22 and consequently will not wet such surfaces or burden them with its drag. Consequently, in the condition assumed in
125 Fig. 3, the only wetted area of the bottom of the boat in the section which this figure represents will include only the surfaces 18, 19 and 20, and the wetted area of the bottom of the boat will consequently be materially reduced over the cor-
130 responding wetted area of boats having bottoms of conventional construction.

It may be here noted that although, as previously mentioned, the water in flowing outwardly
135 over the bottom will usually contact with all of the surfaces 18 to 22 in the extreme stern section, and particularly so in a boat of the type shown in the figures under discussion, it is entirely possible that in certain types of hydroplanes the width of wetted area of the boat bottom may be
140 materially reduced, at least in theory, throughout the entire length of the boat.

It will, of course, be understood that the bow wave is not the only water contacting with the
145 bottom of the boat that has a relative flow outwardly away from the keel, but that all of the water which contacts with the bottom of the boat has such outward movement because of the displacement characteristics of the boat. Consequently, the pocket 40 previously referred to
150 formed between adjacent surfaces of the boat bottom and the various longitudinal steps 26 will continue to be formed throughout the entire length of water contact area of the boat bottom. The maintenance of such pockets 40 is materially

aided in the particular construction illustrated due to the fact that the corresponding steps 26 on opposite sides of the keel 14 converge toward each other in the direction of the stern 12, thus
 5 exaggerating the effect of the outward flow of the water over the same.

An important result of the construction provided by the present invention is that the pockets 40, which are open to the atmosphere at least in
 10 the bow section, are constantly filled with air, and the water in flowing outwardly relative to the keel 14 picks up air from these pockets in the form of small bubbles which are intimately mixed
 15 with a boundary layer of water which contacts with the boat bottom. Due to the fact that this boundary layer passes over successive steps 26 in flowing outwardly away from the keel, larger and
 20 larger amounts of air are picked up by the water until a maximum amount of air is carried thereby at the time it reaches the outer edges of the bilge of the boat. At the same time it will be apparent that the boundary layer of water which
 25 flows under the stern 12 of the boat will have a certain amount of outward movement and will also contain a material amount of air mixed therewith.

The result of this mixture of air with the boundary layer of water is that the boat substantially rides upon an aerated layer of water
 30 which offers very little resistance to the passage of the boat over it. It is my theory that this presence of an aerated layer of water for the boat to ride on is one of the reasons that boats built in accordance with the present invention are
 35 capable of attaining a greater increase in speed with a corresponding increase in engine power than boats built in accordance with conventional constructions.

Referring now to the second reason for converging the corresponding steps 26 on opposite
 40 sides of the keel towards the stern, it is well known that boats of the planing or semi-planing type have a tendency to, and actually do skid when making a turn, toward the outside of the turn.
 45 If a boat is provided with a bottom having longitudinal steps, for instance as in the construction shown, the boat in turning and at the same time skidding, will tend to pile up solid water
 50 adjacent the steps presented outwardly thereto during the turn. Consequently, if these longitudinal steps are parallel to the keel the solid water in building up against such steps will offer so much resistance to the skidding motion as to
 55 endanger tipping over of the boat. I have found however, that when these steps converge toward the stern as described, the forward component of the movement of the boat is sufficiently great as to insure at all times the water flowing over the
 60 steps in a direction from the keel outwardly, and consequently this action effectively prevents the formation of a solid wall of water against those steps facing outwardly on the turn and this effectively eliminates any danger of tipping over of
 65 the boat during a turn except in extreme and unusual conditions.

Furthermore, in constructions where the longitudinal steps are such as to permit the building up
 70 of a body of solid water against the longitudinal steps during a turn, I have found that the steps then act to a greater or lesser extent in the manner of a centerboard, and thus resist any turning movement of the boat whatsoever, and thus not only make the boats dangerous in a
 75 turn but extremely difficult to make a turn with.

The construction illustrated entirely overcomes these difficulties.

Referring now to Figs. 5 to 8 inclusive of the drawings, it will be noted that in these figures a full planing type of boat is illustrated of the
 80 single step type, that is a boat having a single transverse step. The boat shown includes sides 50, stern 51, deck 52 and a bottom including two major planing surfaces indicated generally as at
 85 53 and 54 separated from each other by a transverse step 55. Each of the bottom sections 53 and 54 closely follow the general construction of the stern sections of the boat described in connection with Figs. 1 to 4 inclusive. In other
 90 words, the bow section 53 is formed of a series of planks 56 to 59 inclusive symmetrically arranged on opposite sides of the keel 64 and arranged with their adjacent edges in overlapping relation, each of the planks being positioned at a
 95 higher elevation with respect to the next adjacent plank nearer the keel 64 so as to present a vertical step 65 separating each adjacent substantially horizontal planing surface 60 to 63 inclusive, and extending in the general direction of the length
 100 of a boat a distance commensurate with the corresponding planks. The various corresponding planks 56 to 59 inclusive on opposite sides of the corresponding longitudinal step 65 on opposite
 105 sides of the keel 64, in extending rearwardly, converge toward each other in the same manner for the same purpose as the corresponding steps 26 converge in the direction of the stern of the boat previously discussed in connection with Figs. 1
 110 to 4 inclusive.

Similarly the bottom section 54 is made up of
 110 a plurality of planks 70 to 73 inclusive symmetrically arranged on opposite sides of the keel 64 to present corresponding horizontal vertically displaced planing surfaces 75 to 78 inclusive each
 115 of which is vertically displaced upwardly with respect to the next adjacent surface inwardly towards the keel therefrom so as to present a vertical jog or step 79 therebetween extending in the general direction of the length of the boat and corresponding of which on opposite sides
 120 of the keel 64 converge towards each other in the direction of the stern 51.

In general the bottom of this boat in passing over the water effects the same result as in the construction previously described in that the
 125 water has a relative flow rearwardly, upwardly and outwardly with respect to the keel, and because of the relative outward movement it breaks at each step 65 or 79, as the case may be, to produce air pockets such as 80 (see Fig. 7) between
 130 each step and the planing surface next adjacent thereto outwardly from the keel. Likewise the water in flowing relatively outward with respect to the keel over each of the various longitudinal steps picks up air therefrom which is mixed with
 135 a boundary layer of water to provide an aerated blanket of water for the boat to ride on. Particularly in this type of boat the outer planing surfaces 63 and 78 for instance may, at higher speeds, be entirely clear of water when the boat is
 140 running in a substantially straight line.

In this type of boat as previously mentioned, the reaction of the boat on the water when at speed tends to create a low pressure area immediately to the rear of the step 65, and this low pressure area tends to draw the water up into contact
 145 with the bottom rear section 54 at a point much closer to the step 65 than would otherwise be the case, the result of such tendency, when unchecked, being to increase the wetted area of the boat bot- 150

tom and correspondingly decrease its speed. Where the bottom of the boat is constructed in accordance with the present invention the pockets such as 80 formed between the bottom and the water along each longitudinal step or jog in the forward section 53 of the boat bottom carries sufficient air rearwardly along the boat bottom to the area back of the transverse step 65 to largely eliminate the low pressure area at this point, and this action consequently eliminates the detrimental effects which such low pressure area would otherwise have.

It will of course be obvious that in the construction shown in Figs. 5 to 8 inclusive the same beneficial results of converging the various longitudinal steps or jogs in the direction of the stern result the same as in the construction first described.

Although I have shown but two specific examples of the present invention 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.

I claim:

1. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous water contact when at speed comprised of a multiplicity of longitudinally extending transversely separate planing surfaces extending continuously forwardly and upwardly towards the bow of said boat from a vertically directed surface thereof, each of said planing surfaces having a complementary planing surface on the opposite side of the keel of the boat, each of said planing surfaces being substantially flat in transverse section and being located at a greater elevation, with respect to said keel, than the next adjacent planing surface on that side thereof towards said keel by a distance not greater than twenty-five percent of the width of said surface, and substantially all of said planing surfaces extending rearwardly in generally converging relationship with respect to said keel.

2. A boat of the planing or semi-planing type having substantially all of that portion of the bottom thereof adapted for continuous water contact when at speed comprised of a plurality of longitudinally extending distinct planing surfaces positioned on each side of the keel of the boat, said surfaces being vertically upwardly offset from each other from said keel toward the sides of said boat and being separated from each other by relatively sharp jogs, said jogs and said surfaces terminating sharply at their rear end in at least one upwardly extending surface of said boat and said jogs on opposite sides of said keel extending rearwardly of said boat in converging relationship.

3. A boat of the planing or semi-planing type having substantially the entire bottom surface thereof comprised of a plurality of longitudinally extending planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being located at a greater elevation with respect to said keel than the next adjacent planing surface toward said keel, each of said surfaces being

substantially flat in transverse section, each of said planing surfaces terminating sharply at that margin thereof more remote from said keel in a surface approximately perpendicular thereto, all of said planing surfaces terminating at their rearward ends in at least one vertically directed surface of said boat, and said perpendicular surfaces extending rearwardly of said boat in converging relationship with respect to said keel.

4. A boat of the planing type having substantially the entire bottom area thereof adapted for continuous water contact when at speed formed of a plurality of longitudinally distinct planing areas generally inclined upwardly toward the bow of the boat, each of said areas comprised of a plurality of longitudinally extending planing surfaces arranged in complementary relation on opposite sides of the keel of said boat, each of said planing surfaces being located at a greater elevation with respect to said keel than the next adjacent planing surface toward said keel, each of said surfaces being substantially flat in transverse section, the included angle between the plane of the bottom surface of any such section and a plane extending vertically upwardly from and including said keel being 90° or less, all of said planing surfaces terminating at their rearward ends in at least one vertically directed surface of said boat, and the laterally outer edges of said planing surfaces extending rearwardly of said boat in generally converging relationship with respect to the keel.

5. A boat of the planing type having substantially all of that portion of the bottom area thereof adapted for continuous water contact when at speed formed of a plurality of longitudinally distinct planing areas generally inclined upwardly toward the bow of the boat, each of said areas comprised of a multiplicity of longitudinally extending transversely separate planing surfaces extending continuously forwardly and upwardly towards the bow of said boat from a vertically directed surface thereof, each of said planing surfaces having a complementary planing surface on the opposite side of the keel of the boat, each of said planing surfaces being substantially flat in transverse section and being located at a greater elevation, with respect to said keel, than the next adjacent planing surface on that side thereof towards said keel by a distance not greater than twenty-five per cent of the width of said surface, and said planing surfaces being closer to the keel of said boat at the stern end thereof than at a section taken transversely of said boat forwardly of said stern end.

6. A boat of the planing type having substantially all of that portion of the bottom area thereof adapted for continuous water contact when at speed formed of a plurality of longitudinally distinct planing areas generally inclined upwardly toward the bow of the boat, each of said areas comprised of a plurality of longitudinally extending distinct planing surfaces positioned on each side of the keel of the boat, said surfaces being vertically upwardly offset from each other from said keel toward the sides of said boat and being separated from each other by relatively sharp jogs, said jogs and said surfaces terminating sharply at their rear ends in at least one upwardly extending surface of said boat and said jogs on opposite sides of said keel extending rearwardly of said boat in converging relationship.

GEORGE G. EDDY.