Jan. 31, 1961 | G. G. EDDY | 2,969,760

HULL FORM

Filed March 18, 1957 | 3 Sheets-Sheet 1

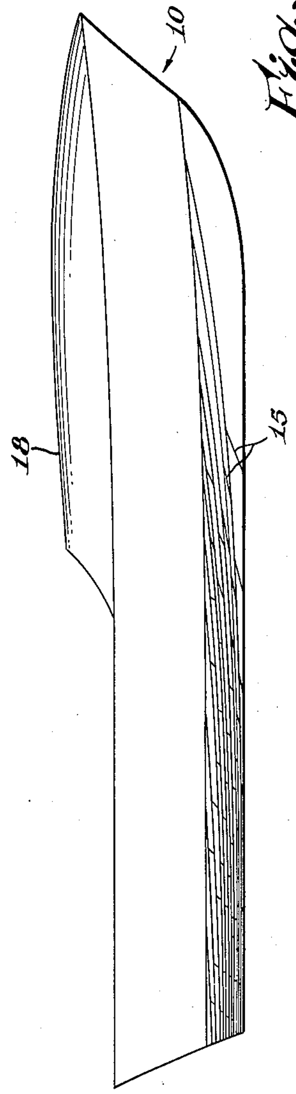

Fig. 3

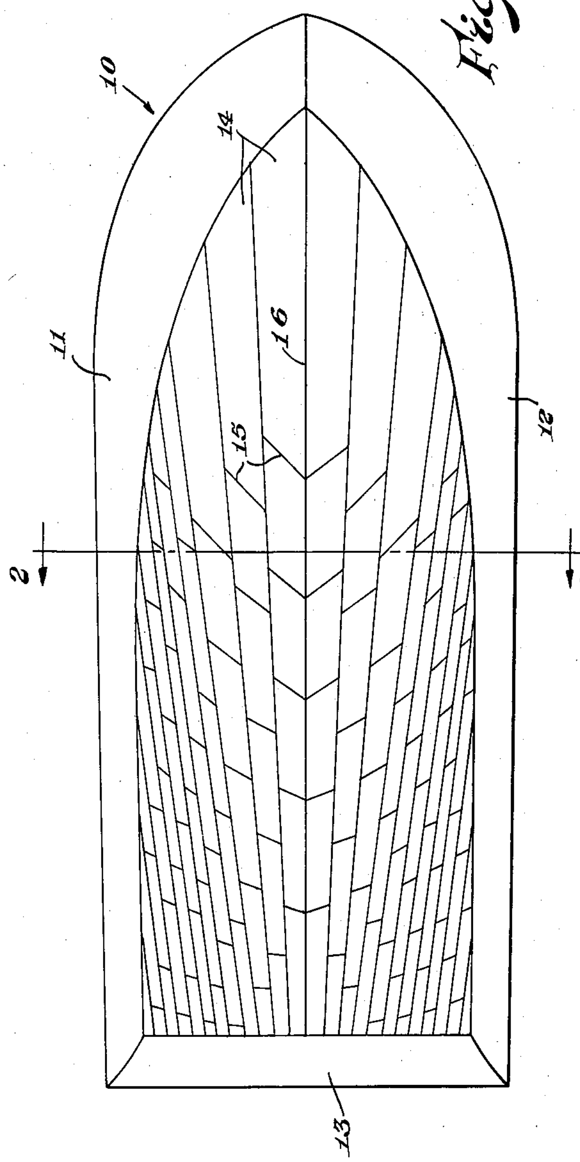

Fig. 1

INVENTOR.
George G. Eddy
BY
James B. Vander Kelen
ATTORNEY

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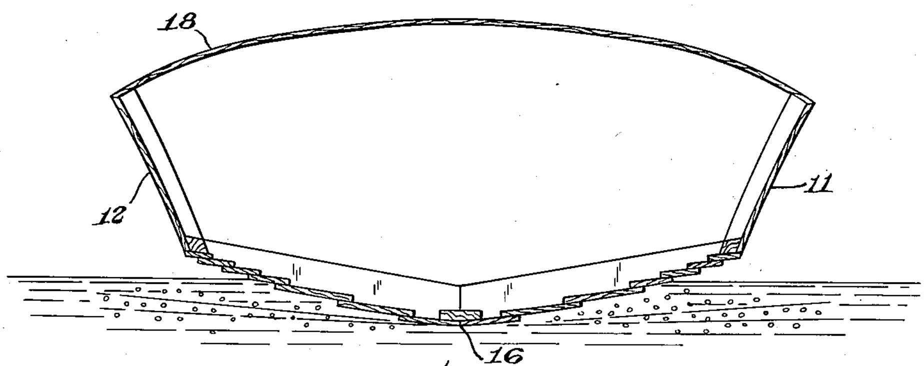

Fig. 2

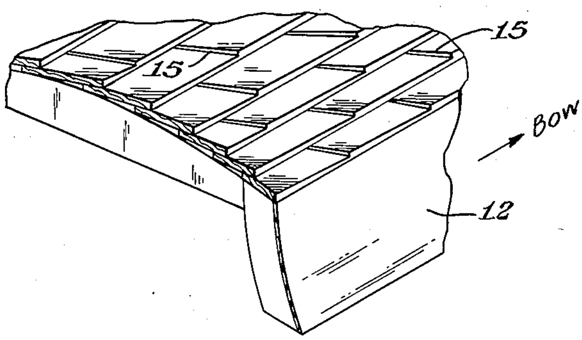

Fig. 7

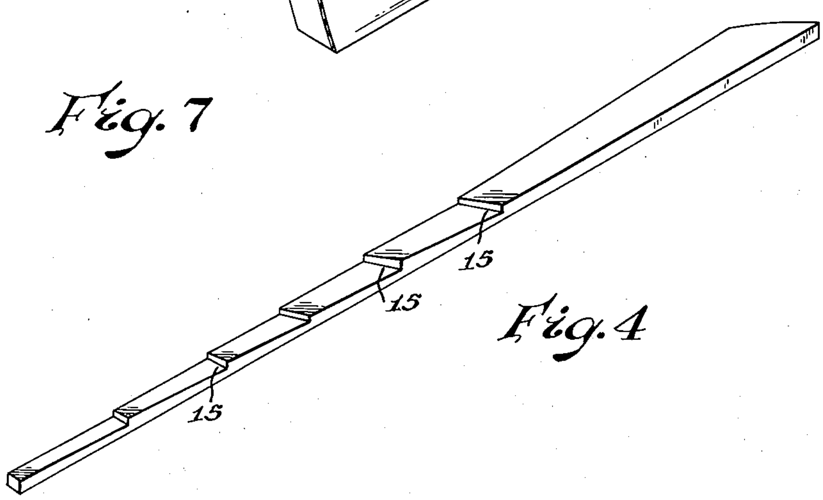

Fig. 4

INVENTOR.
George G. Eddy
BY
James B. Vander Kelen
ATTORNEY

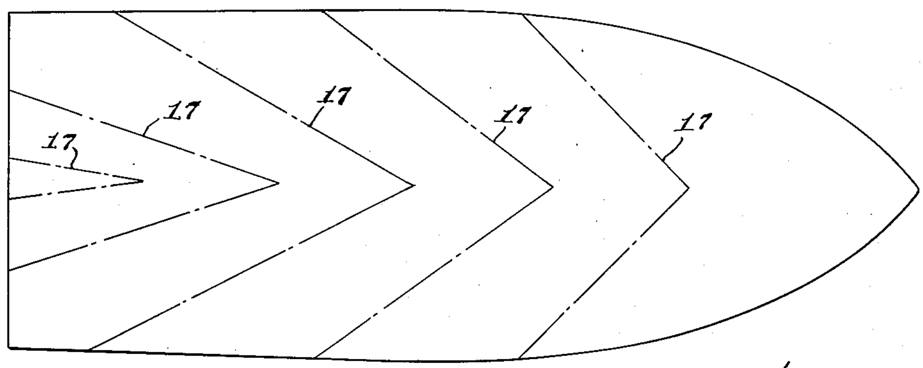

Fig. 5

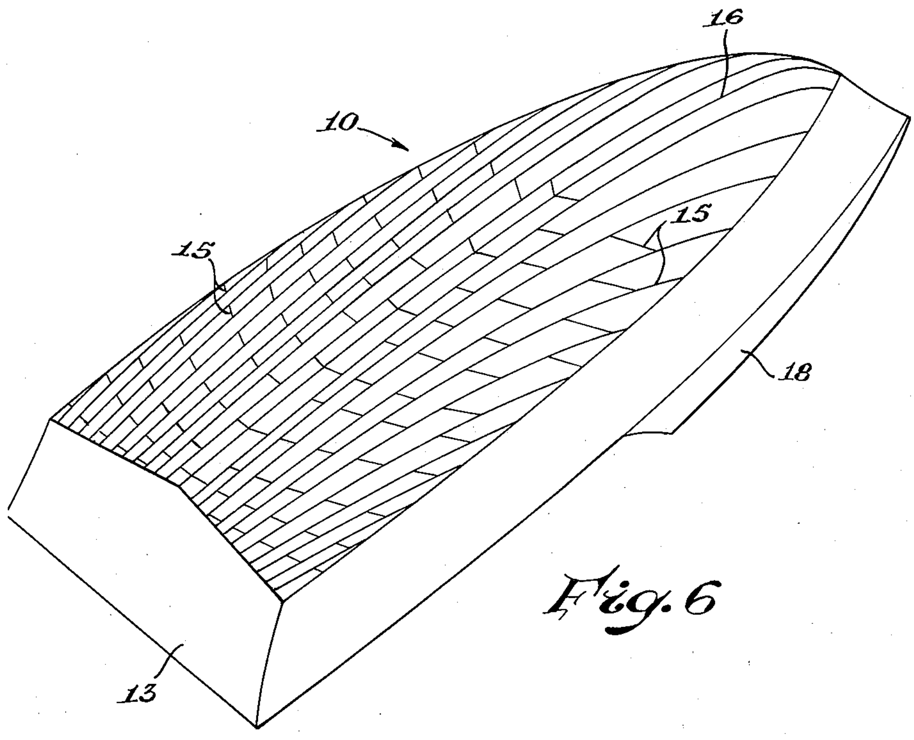

Fig. 6

INVENTOR.
George G. Eddy
BY
James B. Vande Kelen
ATTORNEY

United States Patent Office

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2,969,760

HULL FORM

George G. Eddy, Bay City, Mich.
(Box 1114, Holland, Mich.)

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5 Claims. (Cl. 114—66.5)

This invention relates to a hull form which will pass through a fluid with a reduced drag or resistance and is more particularly concerned with a multiply-stepped planing hull form which intersects fluid pressure patterns to cause a smoothly-planing easily-manuverable boat.

Ideally, a boat having a bottom consisting of one or more flat or nearly flat planing or lifting surfaces, when propelled at a speed on 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 friction occurs between the wet surface of the boat and water, and that there is a displacement of water, ideal planing never actually occurs. The degree to which any hull approaches ideal planing is dependent upon the relationship between the mass of the boat, the speed, the particular hull form employed, and the hydrodynamic reaction characteristics of the planing surfaces of the boat.

The art of building a semi-planing or planing hull form for passage through fluids has been highly developed. Originally, it was thought that a smooth hull form would give fastest and most friction-free contact with a fluid when passing therethrough, therefore, most designers looked to various hull shapes to provide the most efficient hull form. However, when the most efficient hull form had been developed, the coefficient of friction developed by the hull passing through the fluid was found to be quite high and attempts were made to reduce this coefficient of friction. The development of the lap construction, as shown in U.S. Patent 1,935,622, made an advance in reducing the coefficient of friction by providing air spaces between the hull and the water. These air spaces tended to break up the flow of fluid against the hull, thereby substantially affecting the boundary layer of fluid flowing against fluid. U.S. Patents 2,039,585 and 2,039,586 described the use of lapped construction wherein the laps were angled recognizing the existence of pressure patterns and an attempt to overcome the same. U.S. Patent 2,423,860 then developed the art one step further by providing a lapped construction wherein the laps were at angles recognizing presure patterns. Each lap had a number of sharp jogs in an attempt to break up the pressure patterns and reduce the coefficient of friction. None of these designs however, have been completely successful in giving the highest possible speed with the lowest horsepower and highest weight ratio.

It is, therefore, a principal object of the present invention to provide a hull construction which recognizes the importance of water pressure patterns as a factor in decreasing the efficiency of a planing hull. Another object of the present invention is to provide a planing hull form having a multiplicity of steps thereon, each step being at substantially right angles to the pressure patterns developed by the hull planing through a fluid. Still another object of the present invention is to provide a multiplicity of surfaces on a hull form whereby a myriad of air bubbles are introduced between the hull

and the fluid thereby to cause interruption of the boundary layer between a hull and fluid through which it planes. A further object of the present invention is to provide a planing hull form having a lapped construction and a multiplicity of steps thereon, each step intersecting the pressure patterns of the hull planing through a fluid at substantially right angles. Other objects will become apparent hereinafter.

These being among the objects of the present invention, the invention coincides in certain 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.

Fig. 1 is a bottom elevational view of the steps of the present invention as applied to a well known planing hull designed to be operated at an average load condition.

Fig. 2 is a section of the hull shown in Fig. 1, the section being taken at lines 2—2 of Fig. 1.

Fig. 3 is a side elevational view of the hull of Fig. 1.

Fig. 4 is a perspective view of a single longitudinal extending planing surface of the type used to build up a hull of the present invention. It is to be understood that other means of building the hull bottom of the present invention may be used.

Fig. 5 diagrams typical pressure patterns generated by a smooth surface hull at planing speeds.

Fig. 6 is a perspective view of hull of Fig. 1.

Fig. 7 is a perspective section of the hull of Fig. 1 and Fig. 6.

Referring now to the specific drawings, it will be noted that a boat hull **10** having a transom **13** and sides **11** and **12** tapering to a bow **16** is provided. On the bottom of this hull is a planing bottom made of a lapped construction of longitudinally extending planing surfaces **14** extending from the forward portion of the hull **10** to the bottom edge of the transom **13**. On the surface of each of the lapped longitudinally extending planing surfaces **14** are a plurality of steps **15**. These steps are rearward and may be either tapered or rectangular. Each of these steps is at an acute angle from the perpendicular to the keel line **16**. This angle decreases from a maximum nearest the front portion of the hull to a minimum nearest the transom. Ideally, these steps will be perpendicular to the pressure patterns **17** illustrated for a particular hull form at a specific speed in Fig. 5.

It is to be understood that this is a generic drawing for a specific group of pressure patterns under specific conditions. However, generally speaking all hulls planing or semi-planing through a fluid will generate similar patterns, although the specific angles may be different and can be determined by trial and error for each particular hull under different conditions. As has been stated, ideally, the steps **15** are placed perpendicular to the pressure patterns **17** generated by a particular hull under specific conditions. But, since these conditions will vary widely depending upon the horsepower and weight placed on a hull, approaching perpendicular is the best that can be achieved.

As shown in Fig. 7, the steps **15** do not have to be deep, just sufficient to break up the boundary layer of water adjacent to a hull passing through a fluid. Preferably, the steps are sufficiently deep to cause a breaking up of the boundary layer and a consequent interruption of the pressure pattern, but not sufficiently deep to cause an excessive back drag at the step. Thus, by providing a step which is excessively deep, reversal of the normal flow to fill the void caused may be achieved, with the resultant drag adversely affecting the speed of the hull.

While Fig. 2 and Fig. 4 illustrate the preferred method of construction of the hull of the present invention, i.e., a lapped construction of a multiplicity of longitudinally extending planing surfaces **14** having steps **15** thereon, it is to be understood that other methods of achieving the same result may be employed. For example, laying up a plastic material on a conventional smooth hull in a manner so as to provide a multiplicity of steps having the proper angle to intersect the pressure patterns, or by laying up metallic sheet also to form steps at the proper angle are also satisfactory. Other methods of forming the hull bottom of the present invention will be apparent to those skilled in the art.

While it is preferable to have the steps of the present invention intersect the pressure patterns perpendicularly, it will be understood that since ideal conditions are seldom, if ever, obtained, those angles which are perpendicular under most conditions are usually employed. Determination of the pressure patterns is readily accomplished by observing the exit waves of a particular hull form at a particular speed under a given horsepower and weight factor. The steps are then designed to intersect these pressure patterns at right angles. These angles will vary from 45° to 80° near the front of the hull and from 60° to 89° near the rear of the hull, of course, depending on the particular hull form and the conditions under which it is operated.

In order that the invention may be better understood, the following specific description is given, but it is to be understood that the invention is not to be limited thereto.

A 16 foot planing boat frame was provided with a transom, a keel and two plywood sides proceeding from the transom to a junction at the bow. There was also provided a series of longitudinal planing surfaces having a series of 4—5 rearward steps thereon, each step being at an angle less than perpendicular to the keel line, those near the rear being closer to perpendicular than those near the front. Each step was between ⅛ inch and 3/16 inch in depth and extended across substantially the width of the planing surface. A series of seven of these surfaces were placed on each side of the hull frame between the keel and the side, each surface lapping the other surface and providing a ⅜ inch depth of lap.

The resulting boat showed a better speed for unit of horsepower and weight over a similar hull having a smooth planing surface, a reduced frictional contact area, a reduced surface tension effect, that is, a reduced frictional resistane resulting from adhesian of surface tension, a smoother ride due to the increased amount of air under the hull, a handling ease, and an increased apparent buoyancy. Additionally, the angle of attack of the hull at the fluid was inherently decreased due to venting and relieving the negative pressure areas, and more speed could be obtained with less power.

While this invention has been particularly described as applying to planing hulls, it is to be understood that it is also applicaple to boats, ships, barges, pontoons, flying boat hulls, etc., that is, any shape which must be moved through a fluid with the resulting generation of pressure patterns and a boundary layer.

Various modifications may be made in the present invention without departing from the spirit or scope thereof, and it is to be understood that I limit myself only as defined in the appended claims.

I claim:

1. A planing hull comprising: sides, transom, keel line, and at least two fluid-contacting surfaces between said sides, said transom and said hull line, a plurality of steps on said fluid-contacting surface, each of said steps being positioned so as to be substantially perpendicular to the pressure patterns developed by said hull planing through a fluid, and each of said steps being of a length substantially less than the distance between said keel line and said sides.

2. A planing hull which comprises: a fluid-contacting surface having a multiplicity of steps thereon, each of said steps being substantially perpendicular to the pressure patterns developel by said hull planing through a fluid and each of said steps having a length substantially less than one-half the distance between the edges of said fluid-contacting surface.

3. A planing hull which comprises: a fluid contacting surface comprising a series of longitudinally extending planing surfaces lapped toward the outer edge, each of said surfaces having a plurality of steps thereon, each step being at an angle less than perpendicular to the keel line and the adjacent steps so located as to form discontinuous lines from said keel line to said outside edge.

4. A planing hull form comprising: sides, transom, keel and a fluid contacting surface consisting of a series of lapping longitudinally extending fluid contacting surfaces containing a multiplicity of rearward steps thereon, each step being at an angle less than perpendicular to the keel, said angle of said steps being closer to perpendicular near the rear of said hull than near the front of said hull, said steps being so positioned as to form discontinuous lines between said keel and said sides, each of said steps having a length substantially less than one half the width of said fluid contacting surface at the position of said step.

5. A planing hull form comprising: sides, transom, keel line and a fluid contacting surface consisting of a longitudinally extending fluid contacting surface, said surface having a multiplicity of rearward steps thereon, those forward steps being at an angle from 45° to 80° from the keel line near the front of said surface and from 60° to 89° from the keel line near the rear of said planing surface, said steps being so positioned as to form discontinuous lines between said keel and said sides, each of said steps having a length substantially less than one half the width of said fluid contacting surface at the position of said step.

References Cited in the file of this patent

UNITED STATES PATENTS

971,029	Fauber	Sept. 20, 1910
1,935,622	Eddy	Nov. 21, 1933
2,039,585	Eddy et al.	May 5, 1936
2,364,541	Makaroff	Dec. 5, 1941

FOREIGN PATENTS

14,627	Great Britain	of 1909