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Rhoda

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[54] **AFTERPLANE FOR MARINE JET-POWERED BOATS**

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[73] Assignee: **Berkeley Pump Company,** Berkeley, Calif.

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[52] **U.S. Cl.** **115/16**

[51] **Int. Cl.** **B63h 11/02**

[58] **Field of Search** ..... 115/11, 12 A, 14, 115/16

[56] **References Cited**

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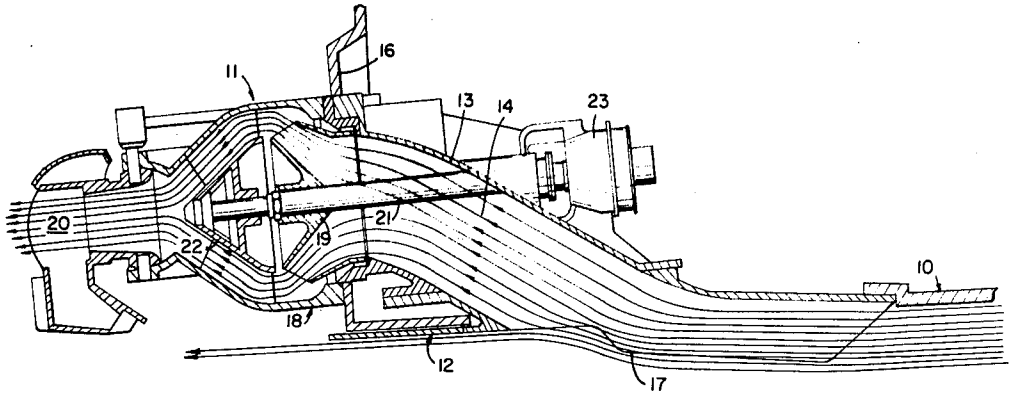
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Primary Examiner—Allen N. Knowles
Assistant Examiner—Gene A. Church
Attorney—Carlisle M. Moore et al.

[57] **ABSTRACT**

In a jet-powered boat wherein water is drawn through an inlet opening in the bottom of the hull, accelerated by an impeller pump and discharged through a jet nozzle to propel the boat forwardly, the improvement wherein an afterplane is secured to the boat rearwardly of the inlet opening, the afterplane being positioned so that the water flowing past the hull just below the layer of water taken into the inlet opening flows past and in contact with the underplane to exert upward forces thereon.

2 Claims, 7 Drawing Figures



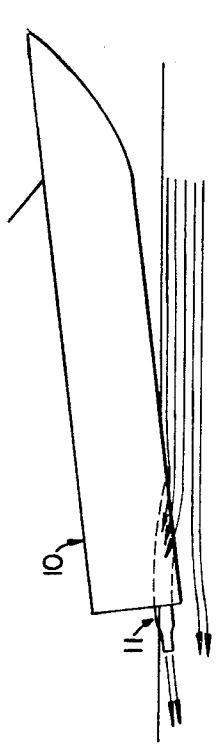


FIG_2

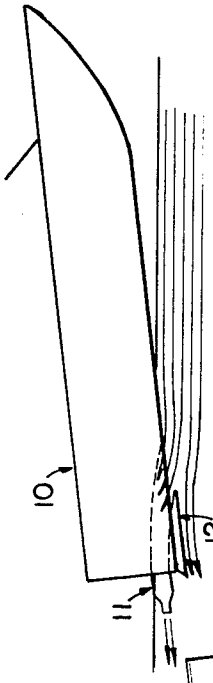


FIG_3

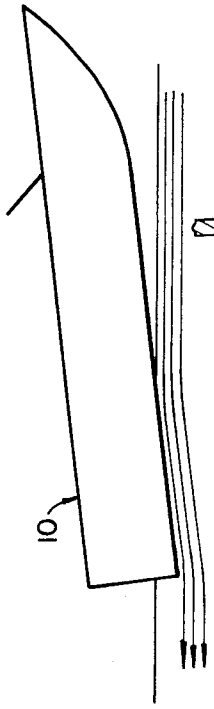


FIG_1

FIG_4

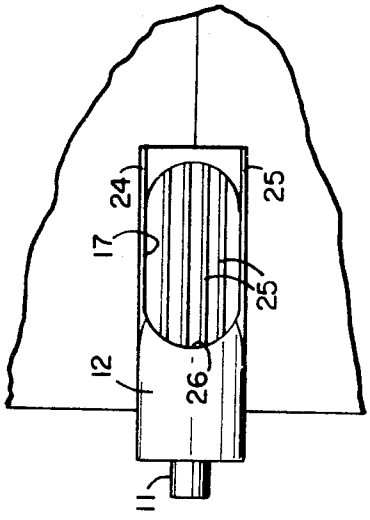


FIG_5

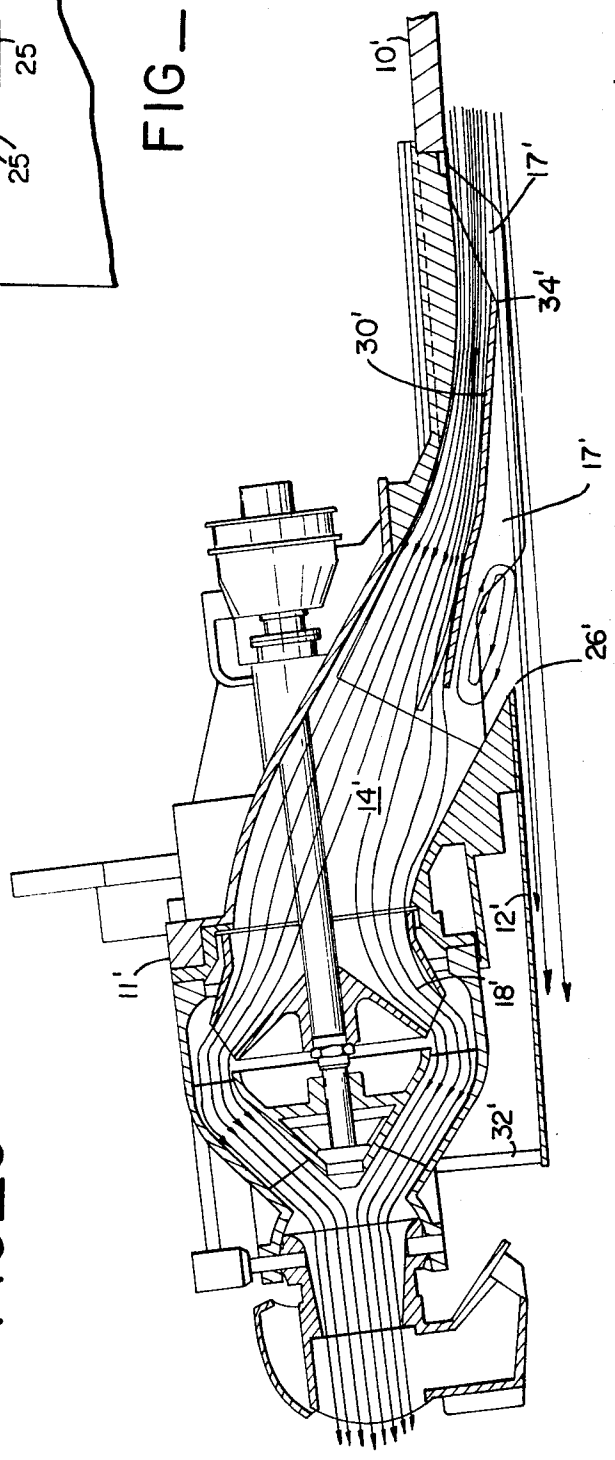


FIG_6

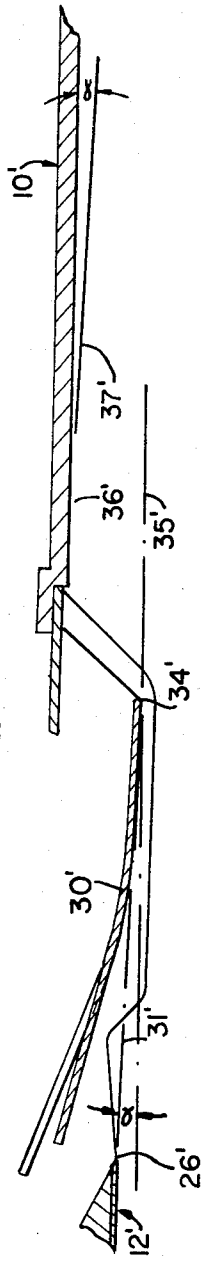


FIG_7

AFTERPLANE FOR MARINE JET-POWERED BOATS

BACKGROUND OF THE INVENTION

This invention relates to jet-powered boats of the type wherein water is drawn in through an opening in the bottom of the hull, delivered to an impeller pump to be accelerated thereby, and discharged through a jet nozzle in the rear to drive the boat forwardly.

The usual practice in the boating industry is for the boat hulls to be designed and manufactured by various boat companies, while the jet propulsion systems are designed and manufactured by other companies, usually specializing in pump manufacture. The normal procedure for installation of the jet propulsion system is to cut openings in the bottom and transom of the hull so that the propulsion system may be fitted into the boat.

I have observed that at times there is an undesirable decrease in the control characteristics of boats equipped with jet propulsion systems, particularly in high-speed boats wherein at high speeds the forward and aft stability changes quickly and radically which in an unpredictable manner, causing a forward and aft bouncing which in turn develops a sidewise rocking and rolling of the boat.

In analyzing the reason why such loss of stability exists, I have discovered that the normal installation of a jet propulsion system in a boat hull creates a "pocket" in the water just aft of the inlet to the jet propulsion, and that this pocket renders the hull area rearwardly of the inlet ineffective for its intended control function.

To illustrate, FIG. **1** shows a boat **10** moving through the water w at a speed sufficiently high to produce planning. The hull is designed by the hull manufacturer so that the water flowing past the hull, indicated by the flow arrows, will flow smoothly past the hull and exert an upward force on the entire planing surface. This upward force, the resultant between the planing surface and the water flowing therepast, and the sideward forces between the upwardly sloping sides of the hull and the water all contribute to providing the proper reactive forces holding the boat at the proper planing angle.

FIG. **2** illustrates the situation when the boat **10** is provided with a jet propulsion unit **11**. Now, the layer of water flowing past and just under the longitudinal center of the hull is taken into the inlet channel leading to the impeller and jet nozzle. As a consequence, the area of the channel inlet is lost as control surface. Further, the water flowing past the hull just under the layer of water scooped into the inlet channel tends to flow in a straight line past and under the portion of the hull aft of the inlet channel. As a consequence, a void v is created between the hull rearwardly of the inlet opening and the water therebelow, and thus there are little if any reactive forces between the water and that portion of the hull.

At low boat speeds, there is a relatively large area of the hull in contact with the water, and the channel inlet and hull immediately aft thereof represents a relatively small percentage of such area. As a consequence the loss of the latter area for control purposes does not unduly affect performance of the boat. However, as the speed of the boat increases, the boat planes higher in the water and the total area of contact between hull and water decreases. At very high speeds, such as encountered with high-power racing boats, only a small

area near the stern of the boat is in contact with the water. Since the inlet channel and hull portion immediately aft thereof are fixed in area, the percentage of area lost for control purposes increases at a rapid rate with increase in boat speed, with a corresponding decrease in boat forward and aft stability.

SUMMARY OF THE INVENTION

To compensate for the loss of control surface described above, I provide an afterplane surface **12** on the boat rearwardly of the inlet opening to the propulsion unit. The afterplane is located relative to the hull such that the water just below the layer scooped into the inlet opening will flow smoothly along the undersurface of the afterplane. The void otherwise existing below the hull aft of the inlet opening is thus eliminated and the water rearwardly of the inlet opening is in full reactive contact with the afterplane as with the rest of the planing surface of the hull.

Other objects and advantages will become apparent in the course of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings forming a part of this application and in which like parts are designated by like reference numerals throughout the same,

FIG. **1** illustrates the flow of water past a planing boat;

FIG. **2** illustrates the flow of water past a planing boat having a jet propulsion system;

FIG. **3** illustrates the flow of water past a planing boat having a jet propulsion system and an afterplane surface in accordance with the present invention;

FIG. **4** is a sectional view, in elevation of the aft portion of a jet boat, illustrating the jet propulsion system and the afterplane;

FIG. **5** is a bottom view, of a portion of a jet boat, illustrating the jet propulsion inlet and the afterplane;

FIG. **6** is a sectional view similar to FIG. **4** illustrating a modified form of propulsion system and an afterplane associated therewith.

FIG. **7** is a detail view of the system of FIG. **6** illustrating the positional relationship of the afterplane and the inlet channel.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, FIGS. **4** and **5** illustrate a boat **10** having a jet propulsion unit **11** in which a housing **13** forming a water flow channel **14** therein extends downwardly through the bottom of the hull **10** and rearwardly through the transom **16** of the boat. Water thus can flow into the channel inlet **17** and through the flow channel **14** to the impeller pump **18**. The impeller **19** accelerates the flow of the water and forces it rearwardly through the jet nozzle **20** to drive the boat forwardly. The impeller is mounted on drive shaft **21**, the latter being journaled in rear and forward bearings **22** and **23** and adapted to be driven by a conventional marine engine (not shown). The housing **13** is provided with downwardly depending side flanges **24** and the flow channel inlet **17** is provided with a plurality of longitudinal grill members **25** which prevent debris in the water from entering the jet propulsion system.

An afterplane plate **12** is fixed to the hull of the boat, by any conventional means such as screws or the like,

the forward edge 26 of the afterplane being disposed at the rear edge of the inlet opening 17. The afterplane 12 has a width equal to the width of the inlet opening and extends a substantial distance from the rear edge of the inlet opening. The length will depend on the design of the particular boat with which it is to be used since different hulls may require different areas of afterplane surface for proper control of the boat.

The undersurface of the afterplane 12 is preferably shaped transversely the same as the planing surface of the hull thereabove, although some variation therefrom may be found to provide for optimal boat handling. The afterplane is also preferably parallel to the planing surface of the hull, although, again, the afterplane may be inclined slightly to the hull to increase or decrease the lift effect, as desired.

The afterplane 12 is located parallel to the hull so that the water just under the layer taken into the inlet opening 17 will kiss the forward edge 26 of the afterplane and then flow smoothly past the undersurface of the afterplane. If the afterplane is too high, then a water pocket will be formed thereunder and a loss of control will result. If too low, then the forward edge will bite into the water just under that entering the flow channel inlet 17, producing turbulence, drag and reduction is control characteristics. For different hull designs and propulsion systems the location of the afterplane will vary, and the location will have to be determined empirically to give the results above described.

FIG. 6 illustrates a boat 10' equipped with a jet propulsion system 11' having a guide vane 30' in the flow channel 14' and projecting outwardly and forwardly therefrom to provide for better flow distribution in flow channel 14' to the impeller pump 18'. As more fully described in my copending application, Ser. No. 236,394, filed Mar. 30, 1972, and entitled "Guide Vane for Suction Side of Marine Jet Propulsion System," the guide vane 30' functions to adjust the relative water flow through the flow channel portions above and below the vane in accordance with boat speeds. At boat speeds above the impeller entrance velocity the flow through the flow channel below the vane will decrease, and at the maximum design speed of the boat no water will flow through the flow channel 14' below the guide vane 30'.

An afterplane 12', substantially as described with reference to FIGS. 4 and 5, is mounted on boat 10' so that its forward edge 26' is at the rear edge 17' of the flow channel inlet 17'. The rear end of afterplane 12' may be mounted in fixed position by struts 32' which extend upwardly to the housing of the jet propulsion system.

FIG. 7 illustrates the proper placement of the forward edge 26' of the afterplane 12' with relation to the guide vane 30'. A line 31' drawn from the forward edge 26' of the afterplane 12' to the forward edge 34' of the guide vane 30' forms an angle α to a line 35' which is drawn through the forward guide vane edge 34' parallel to the planing surface 36' of the boat hull. The angle α between lines 31' and 35' is equal to the planing angle α of the boat, i.e., the angle between the planing surface 36' of the boat and the water surface 37'. With this placement, the layer of water just below that entering the inlet channel below the guide vane will flow under and against the afterplane. At the boat speed wherein all water flowing through the flow channel flows through above the guide vane the layer of water passing just below the forward edge of the guide vane will strike the forward edge of the afterplane and flow therealong, as shown in FIG. 6, providing the proper control function by the reaction of the water with the afterplane and also providing the proper pressure at the inlet to the flow channel below the guide vane to prevent flow therethrough.

Having thus described my invention, I claim:

1. In a jet boat having a jet propulsion system including a rearwardly projecting jet nozzle, an impeller pump discharging into said nozzle, and a flow channel from the impeller pump to a water inlet in and through the bottom of the hull of the boat, the improvement comprising:

an afterplane plate mounted on said boat, said afterplane plate having a width substantially equal to the width of said flow channel inlet and extending a substantial distance rearwardly from the rear edge of said flow channel inlet, said afterplane plate being substantially parallel to the planing surface of the hull in the vicinity of said flow channel inlet, and said afterplane plate being positioned vertically relative to said boat that water flowing just under the water taken into said flow channel will flow against and along said afterplane plate in upward reactive engagement therewith.

2. In a jet boat as set forth in claim 1, wherein said boat has a guide vane in said flow channel, which guide vane projects outwardly and forwardly from said flow channel inlet, and wherein the angle between a line drawn from the forward edge of said afterplane plate to the forward edge of said guide vane and a line drawn through the forward edge of said guide vane parallel to said planing surface of said hull is substantially equal to the planing angle of said boat.

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