United States Patent

[11] 3,626,894

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[54] **TUNNEL STERN BOAT**
11 Claims, 11 Drawing Figs.

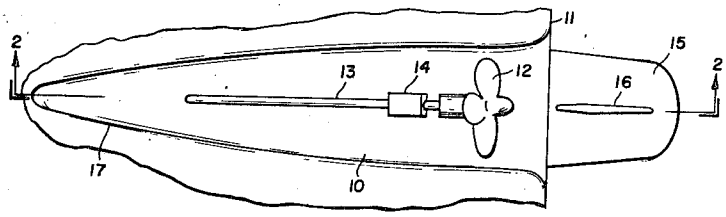
[52] **U.S. Cl.** **115/39**
[51] **Int. Cl.** **B63h 5/16**
[50] **Field of Search** 115/34, 39; 114/61, 66.5

[56] **References Cited**
UNITED STATES PATENTS

3,138,130	6/1964	Morgan	115/39 X
3,515,087	6/1970	Stuart	115/39 X

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Assistant Examiner—Carl A. Rutledge
Attorney—Cumpston, Shaw & Stephens

ABSTRACT: The tunnel of a tunnel stern planing boat is given an improved shape for greater efficiency. The tunnel is gradually and smoothly enlarged as it extends aft toward the propeller, and it has a semicylindrical top fitting relatively closely over the propeller in the plane of the propeller. Then the tunnel extends aft of the propeller a short distance with a gradually enlarging cross-sectional area preferably formed by divergent sidewalls of the tunnel.



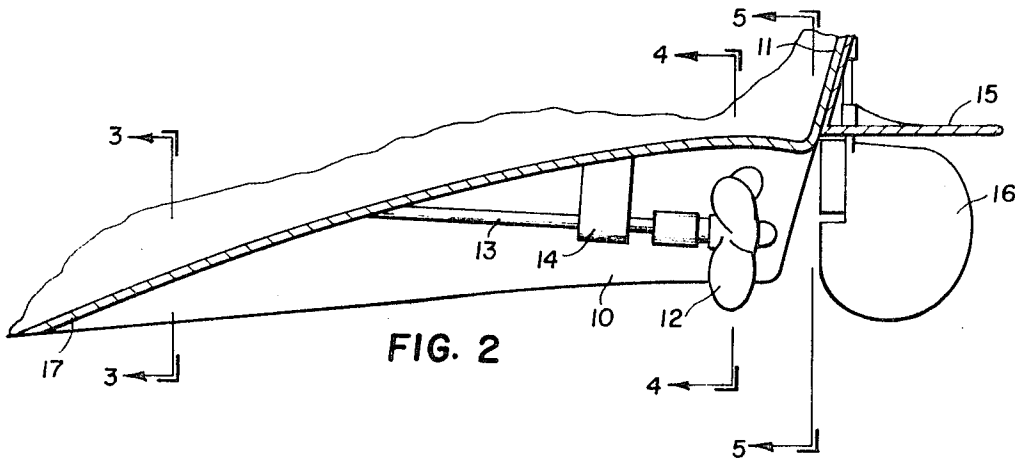


FIG. 2

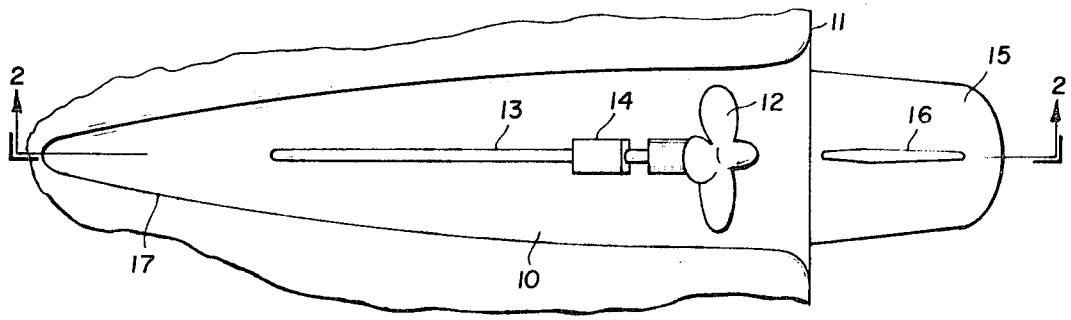


FIG. 1

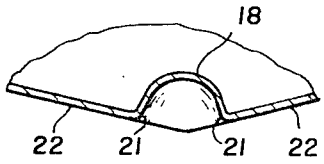


FIG. 3

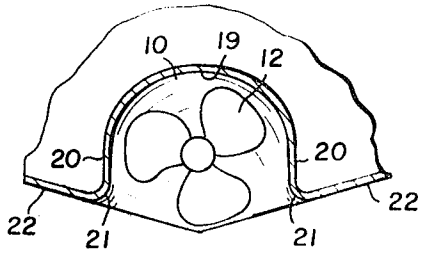


FIG. 4

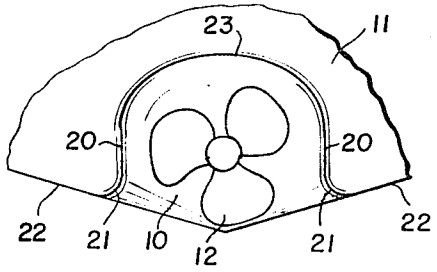


FIG. 5

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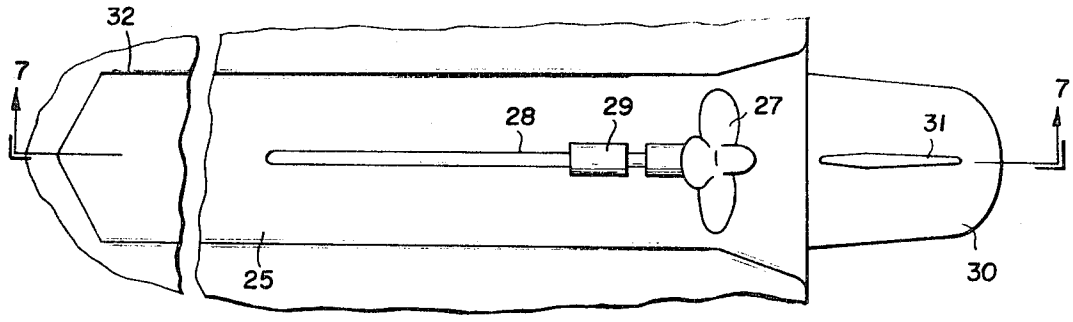


FIG. 6

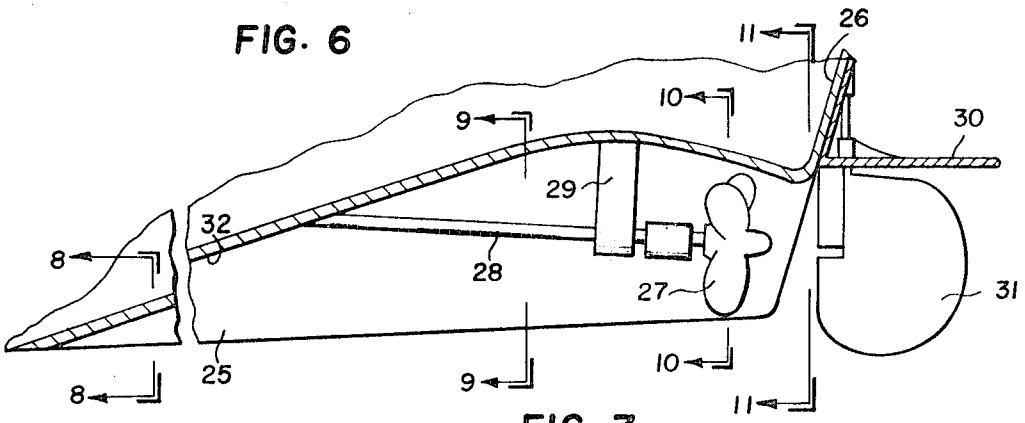


FIG. 7

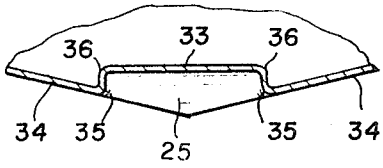


FIG. 8

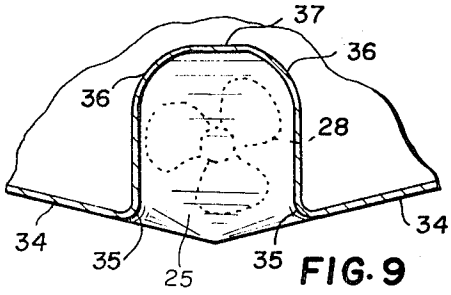


FIG. 9

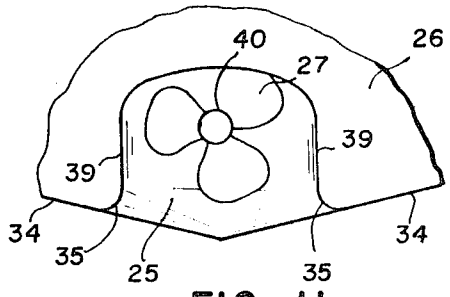


FIG. 11

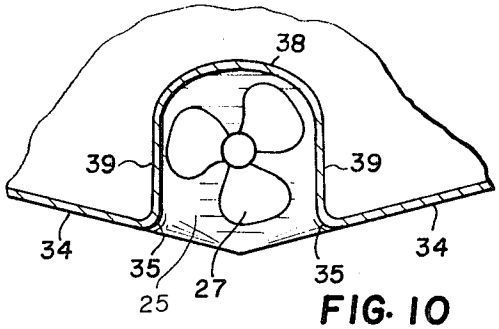


FIG. 10

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TUNNEL STERN BOAT

THE INVENTIVE IMPROVEMENT

Tunnel sterns have been most successful in displacement hulls, and most of the previous suggestions for tunnel stern planing boats operating at high speeds have been unworkable. However, I recently developed a tunnel stern construction that works very well in planing boats, and many of the features of my construction are covered in my U.S. Pat. No. 3,515,087. In building and experimenting with high-speed, tunnel stern boats I have discovered that some tunnel shapes are much more efficient than others, and I have developed optimum tunnel shapes for highest speed and engine r.p.m. and general efficiency in driving a high-speed, planning boat. I have discovered that tunnel shape is very important, and I have made some important changes in tunnel shapes.

SUMMARY OF THE INVENTION

The inventive tunnel shape applies to a tunnel stern planning boat having a tunnel open at the transom end of the boat, a propeller in the tunnel, and a rudder aft of the tunnel. The portion of the tunnel forward of the propeller is gradually enlarged in cross-sectional area as it proceeds aft toward the propeller, and in the plane of the propeller the tunnel has a semicylindrical top portion that fits relatively closely over the propeller. The tunnel extends a relatively short distance aft of the propeller, and has a cross-sectional area that gradually enlarges with distance aft of the propeller to give a slight flare to the tunnel.

DRAWINGS

FIG. 1 is a bottom view of a preferred embodiment of the inventive tunnel stern;

FIG. 2 is a cross section view of the tunnel stern of FIG. 1 taken along the line 2—2 thereof;

FIGS. 3–5 are cross-sectional views of the tunnel stern of FIG. 2 taken respectively along the lines 3—3, 4—4, and 5—5 thereof;

FIG. 6 is a bottom view of an alternative preferred embodiment of the inventive tunnel stern;

FIG. 7 is a cross section view of the tunnel stern of FIG. 6 taken along the line 7—7 thereof; and

FIGS. 8–11 are cross-sectional views of the tunnel stern of FIG. 7 taken respectively along the lines 8—8, 9—9, 10—10, and 11—11 thereof;

DETAILED DESCRIPTION

The improved tunnel shape according to the invention is intended for high-speed, planing boats but can be applied to other tunnel stern boats that have displacement bulls or are relatively slow. Since tunnel stern boats are generally understood in the art, and since details or particulars of the rest of the boat are not involved in the invention, only the tunnel stern fragment of a boat has been illustrated in the drawings. Those skilled in the art will understand how to apply the inventive tunnel shape to a wide variety of hull shapes and sizes and boat designs.

A rounded or arched top tunnel 10 is illustrated in FIGS. 1–5. Tunnel 10 opens at transom 11, and a propeller 12 is turned on a shaft 13 supported by strut 14 in tunnel 10. A spray plate 15 is arranged aft of transom 11, and a rudder 16 is arranged under spray plate 15 in the high speed stream of water thrust relatively aft from propeller 12.

The inventive shape of tunnel 10 includes several important features. The portion of tunnel 10 forward of propeller 12 gradually enlarges in cross-sectional area as it proceeds aft toward propeller 12. At its forward end, tunnel 10 begins with a small arch recessed into the bottom of the boat, and the arch gradually grows both taller and wider as illustrated by the arch 18 of FIG. 3. The arch of tunnel 10 reaches full height and width a little forward of propeller 12, and its shape in the plane of propeller 12 is illustrated in FIG. 4. In this region the

tunnel arch has a semicylindrical top portion 19 that fits relatively closely over propeller 12. A running clearance of less than an inch is preferred between propeller 12 and semicylindrical arch 19. Sidewalls 20 extend straight down from semicylindrical arch 19 from the axis of propeller 12 downward toward the bottom of tunnel 10, and rounded edges 21 join tunnel walls 20 to hull bottom 22. Rounded edges 21 preferably extend along the entire length of tunnel 10 to facilitate resurgent flow of displaced water into tunnel 10. Rounded edges 21 are preferably curved on a relatively small radius so as not to reduce substantially the amount of surface 22 available for dynamic lift.

Tunnel 10 proceeds a relatively short distance aft of propeller 12 as illustrated. Such after extension of tunnel 10 is preferably about one-half the radius of propeller 12. The cross-sectional area of regions of tunnel 10 aft of propeller 12 are gradually enlarged with distance aft of propeller 12 as best shown in Flg. 5, illustrating tunnel 10 at transom 11. The top 23 of tunnel 10 at transom 11 is at the same upper level as semicylindrical top 19, but sidewalls 20 are flared horizontally outward and rounded into a junction with transom 11 as exaggerated in FIG. 1. The cross-sectional area of any plane of tunnel 10 aft of propeller 12 is larger than the cross-sectional area of any plane closer to propeller 12. The flare in sidewalls 20 is preferably from 5° to 15° from parallel and this depends in part upon whether top 23 is flared upward, made horizontal, or turned downward.

FIGS. 6–11 show another preferred embodiment of the inventive tunnel stern. Tunnel 25 opens at transom 26, and a propeller 27 is turned on shaft 28 and supported by strut 29 in tunnel 25. A spray plate 30 and a rudder 31 are arranged aft of tunnel 25.

Tunnel 25 quickly broadens at its forward end 32 into a generally rectangular shape having a width slightly larger than the diameter of propeller 27. The recess 33 formed by tunnel 25 gradually rises above hull bottom 34 and enlarges in cross-sectional area as it proceeds aft toward propeller 27, as shown in FIG. 8. The lower edges 35 that join tunnel 25 to hull bottom 34 are preferably rounded as described above for edges 21. The radius of internal corners 36 of recess 33 are gradually increased as tunnel 25 proceeds aft toward propeller 27. In the region just forward of propeller 27, as illustrated in FIG. 9, corners 36 have such large radii that they have nearly eliminated flat top portion 37. Also, tunnel 25 in this region extends above propeller 27 in a humpbacked configuration of maximum cross-sectional area. The height of tunnel 25 above propeller 27 is shown by setting out the position of propeller 27 in phantom in FIG. 9.

The shape of tunnel 25 in the plane of propeller 27 is illustrated in Fig. 10. A semicylindrical top portion 38 fits closely over the top of propeller 27 in the same manner as previously described semicylindrical top portion 19. Straight sidewalls 39 extend downward from semicylindrical top portion 38 to rounded edges 35 that join the tunnel to hull bottom 34.

Tunnel 25 also increases in cross-sectional area with distance aft of propeller 27 as previously described. Tunnel top 40 aft of propeller 27 curves downward somewhat below the top of propeller 27 as best shown in FIG. 11, to direct the propeller stream downward and to secure some dynamic lift from interaction with the propeller stream. THis tends to constrict the top of the flow of water somewhat in the propeller stream, and is compensated for by a somewhat larger flare in sidewalls 39. Sidewalls 39 are angled outward and rounded into transom 26 with a sufficient flare so that aft of propeller 27 any cross-sectional plane of tunnel 25 is larger than any other plane closer to propeller 27. The propeller stream is then turned or deformed from a cylindrical shape to a somewhat elliptical shape as it is discharged from tunnel 25.

Experience has shown that the smoothing, rounding, gradually enlarging of the tunnel shape, and especially flaring the portion of the tunnel aft of the propeller, produces a marked increase in power, speed, and efficiency. Generally excellent performances have been improved as much as 8 per-

cent by these measures, so that the inventive tunnel shape offers a substantial advantage in boat design. Those skilled in the art will understand how to apply the inventive concepts in many particular circumstances.

Persons wishing to practice the invention should remember that other embodiments and variations can be adapted to particular circumstances. Even though one point of view is necessarily chosen in describing and defining the invention, this should not inhibit broader or related embodiments going beyond the semantic orientation of this application but falling within the spirit of the invention.

I claim:

1. In a tunnel stern planing boat having a tunnel open at the transom of said boat, a propeller arranged in said tunnel, means for rotating said propeller, and a rudder arranged aft of said tunnel, an improved tunnel shape comprising:

a. the portion of said tunnel forward of said propeller having a gradually enlarging cross-sectional area proceeding aft toward said propeller;

b. in the plane of said propeller, said tunnel having a top portion fitting relatively closely over said propeller;

c. said tunnel extending a relatively short distance aft of said propeller; and

d. the portion of said tunnel aft of said propeller having a cross-sectional area that gradually enlarges with distance aft of said propeller.

2. The tunnel shape of claim 1 wherein the walls of said tunnel portion aft of said propeller diverge at an angle of from 5° to 15°.

3. The tunnel shape of claim 1 wherein said enlarging cross-sectional area aft of said propeller is provided by divergent sidewalls of said tunnel.

4. The tunnel shape of claim 1 wherein said tunnel extends aft of said propeller for a distance approximately equal to one-half a radius of said propeller.

5. The tunnel shape of claim 1 wherein said top portion is semicylindrical.

6. The tunnel shape of claim 1 wherein said tunnel portion forward of said propeller is generally rectangular in cross section and is formed to blend gradually into said top portion.

7. The tunnel shape of claim 6 wherein said forward portion of said tunnel has a substantially constant width and enlarges in height as it proceeds aft.

8. The tunnel shape of claim 1 wherein said tunnel portion forward of said propeller is generally arch-shaped in cross section and enlarges in both width and height as it proceeds aft.

9. The tunnel shape of claim 1 wherein junction edges between said tunnel and the outer hull surface of said boat are rounded and smooth.

10. The tunnel shape of claim 1 wherein a region of said tunnel just forward of said plane of said propeller has a cross-sectional area larger than the cross-sectional area of said tunnel at said plane of said propeller.

11. The tunnel shape of claim 10 wherein said enlarging cross-sectional area of said tunnel portion aft of said propeller is provided by divergent sidewalls of said tunnel.

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