United States Patent [19]

Hurwitz

[11] **3,812,812**

[45] **May 28, 1974**

[54] **TROLLING PROPELLER WITH SELF ADJUSTING HYDRODYNAMIC SPOILERS**

[76] Inventor: **Mathew Hurwitz,** 63 Oakland Ave., Auburndale, Mass. 02166

[22] Filed: **June 25, 1973**

[21] Appl. No.: **373,397**

[52] **U.S. Cl.** ..... **115/34 R,** 114/145 R, 416/236

[51] **Int. Cl.** **B63h 1/14**

[58] **Field of Search**.... 416/240, 235, 236 R, 236 H, 416/237, 132, 62; 114/145 R, 145 A; 115/34 R; 244/42 D; 404/10, 11

[56] **References Cited**

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Primary Examiner—George E. A. Halvosa
Assistant Examiner—Edward R. Kazenske
Attorney, Agent, or Firm—Arnstein, Gluck, Weitzenfeld & Minow

[57] **ABSTRACT**

A marine propeller carrying a plurality of hydrodynamic spoilers formed of elastomeric material which self-deploy at low engine speeds to present maximum effective fluid contacting areas impeding propeller flow, said effective areas being progressively reduced as the propeller speed progressively is increased or its direction of rotation reversed. The propeller manifests a greater-than-normal slip coefficient at low engine speed thus, decreasing the minimum trolling speed without sacrificing performance in reverse or at intermediate and high engine speeds.

3 Claims, 9 Drawing Figures

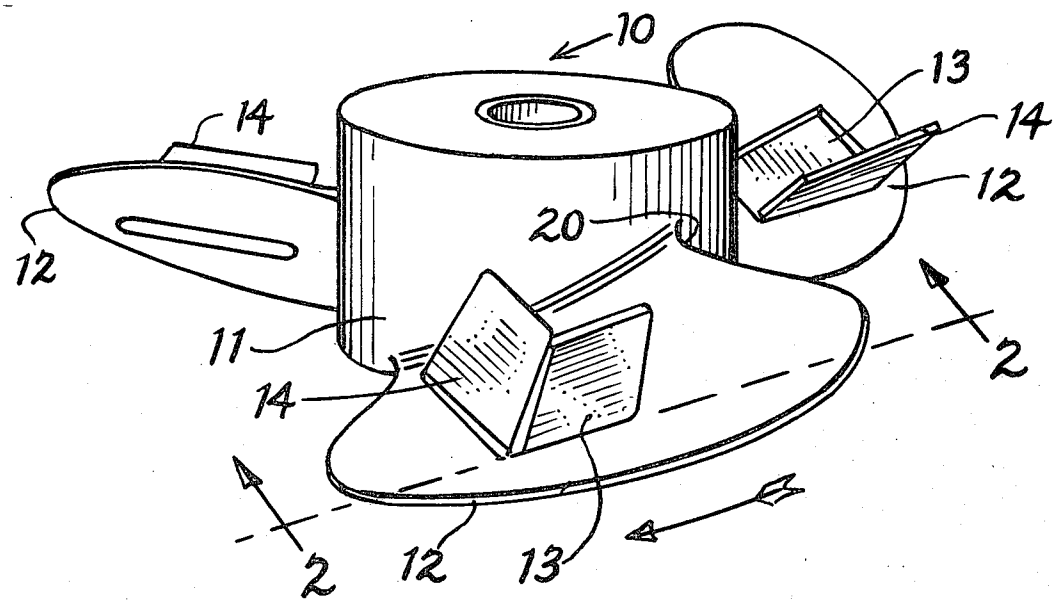


FIG. 1

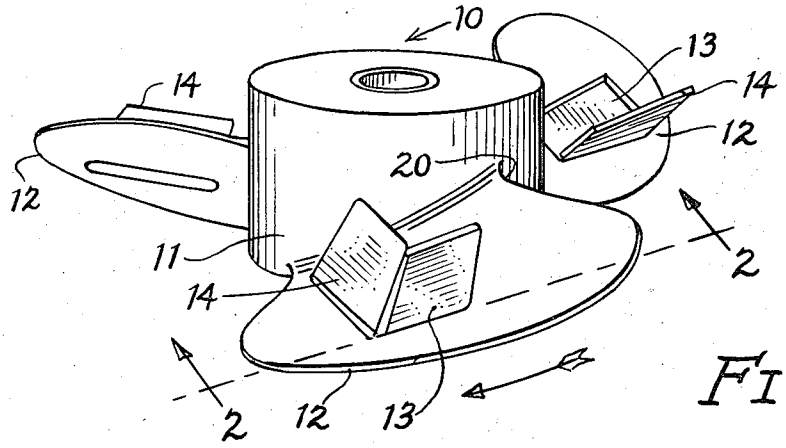


FIG. 2

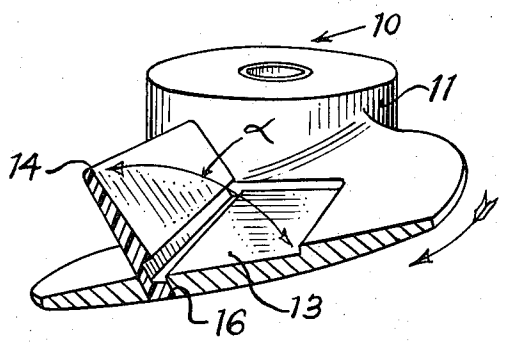


FIG. 3

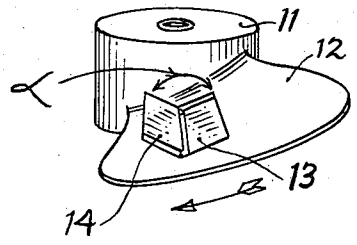


FIG. 4

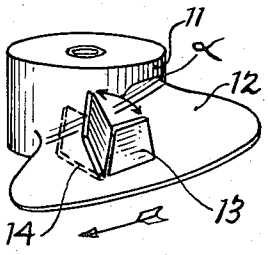


FIG. 5

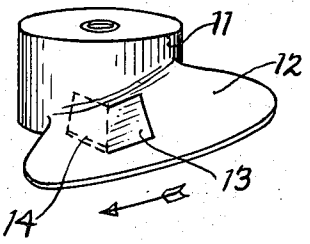


FIG. 6

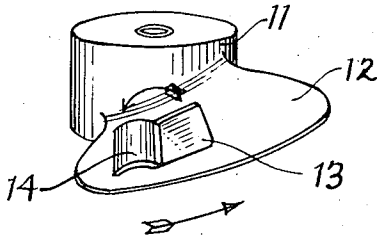


FIG. 7

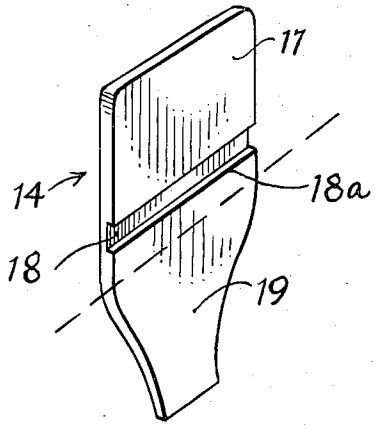


FIG. 8

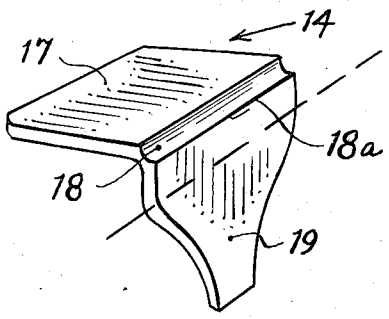
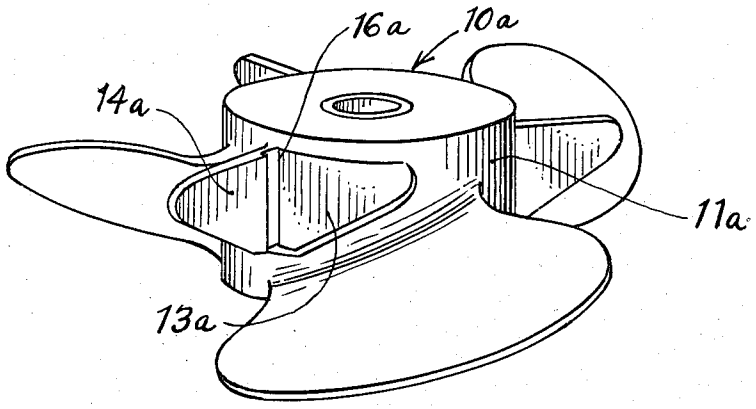


FIG. 9



TROLLING PROPELLER WITH SELF ADJUSTING HYDRODYNAMIC SPOILERS

BACKGROUND OF THE INVENTION

Small air-cooled, two cycle outboard motors in the 2–15 horsepower range are popular with sportsmen because of their low cost and simplicity. However, because many of these motors are incapable of operating continuously at very low speeds they cannot be used satisfactorily for low speed trolling. Typically, any attempt to operate most economy priced outboard motors at idling speeds below 700–800 rpm usually results in fouling and stalling within a few minutes. Manifestly, this problem limits the usefulness of such engines for fishermen desiring to troll at low speeds. The normal idling speed may be somewhat decreased by increasing the fly wheel mass but, this expedient, if carried to excess, unduly increases the starting effort, not to mention engine weight and cost. Accordingly, many sportsmen resort to carrying an electric outboard motor as an auxiliary power source to provide acceptable low speed operation. However, the added expense, and inconvenience of owning an auxiliary electric trolling motor which requires the use of a storage battery and means for recharging the same, in many instances, is sufficient to persuade many sportsmen to avoid using the economy-priced, air-cooled, two-cycle outboard engines and, instead, to purchase more costly outboard motors than they might otherwise consider merely in order to enjoy lower idling speeds.

Numerous attempts have been made to solve the trolling problem in outboard motors through the use of variable pitch propellers, transmissions, trolling plates and electric auxiliary motors.

Variable pitch propellers and the means for actuating them either manually or automatically are known to be capable of providing arbitrarily low trolling speeds without impairing performance in reverse operation or at intermediate and top forward speeds. However, variable pitch propellers embody complex mechanisms and most require substantial modifications of the outboard motor structure. As a consequence, the added cost of such a feature is prohibitive in small economy priced outboard motors.

Trolling transmissions offer another means for attaining the objective but such mechanisms significantly increase the complexity and cost of the gear case with the result that the use of transmissions is not considered a practical solution for low cost outboard motors.

Trolling plates of various types have been proposed for achieving a solution. Typically, these devices consist of a suitable plate which is placed just behind or just ahead of the propeller. This plate when deployed slows the boat by impeding propeller flow thereby achieving trolling speeds. The plate is intended to be moved to an inoperative position when unimpeded operation of the engine is desired. Trolling plates have been slow to gain favorable acceptance because of their tendency to become fouled in weeds and their vulnerability to injury when they impinge on underwater obstructions at high speeds. In addition, most trolling plates must be manually manipulated which many sportsmen find to be an inconvenience.

Electric auxiliary motors mounted in close proximity to the anti-cavitation plate of an outboard motor offer another expedient for achieving both low and high speeds within one and the same package. Such motors add considerably to underwater drag at high speeds and consequently, an outboard motor carrying such an auxiliary cannot deliver the intermediate and top speed performances of the same motor without the auxiliary. The high cost and vulnerability to injury have mitigated against the practical use of such auxiliary motors.

SUMMARY OF THE INVENTION

The primary object of this invention is the provision of an improved propeller for outboard motors which reduces the minimum boat speed without requiring a reduction in minimum motor speed.

Another object of the present invention is the provision of an improved propeller which delivers substantially the same efficiency at intermediate and high engine speeds as a conventional propeller but, which at low engine speeds, exhibits a higher slip coefficient than a conventional propeller.

Another object of this invention is the provision of a propeller having retractible hydrodynamic spoiler flaps or tabs mounted on the blades or hub of the propeller, the flaps or tabs being arranged to afford maximum interference with propeller flow at relatively low engine speeds while affording minimal impedance to flow at intermediate and higher engine speeds.

Still another object of this invention is the provision of a novel propeller which is simple and economical to manufacture and is durable in service.

Other and further objects and advantages of this invention will become apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a marine propeller embodying the features of the invention.

FIG. 2 is a fragmentary perspective view of the invention, partly in cross-section.

FIGS. 3–6 are fragmentary perspective views of a propeller, in accordance with my invention, showing the different positions assumed by the spoiler flaps under different conditions of operation.

FIG. 7 is a perspective view of a spoiler flap.

FIG. 8 is a similar view showing another type of spoiler flap, and

FIG. 9 is a perspective view of another embodiment of my invention.

BRIEF DESCRIPTION OF A PREFERRED EMBODIMENT

The propeller **10** of the present invention is of generally conventional configuration and includes a hub **11** having a plurality of integral blades **12** extending outwardly thereof. While three blades are illustrated, it will be understood that my invention is applicable to propellers having two or more blades. Each of the blades **12** is provided on its thrusting surface with a generally rectangular recess **13** preferably located centrally of the blade surface. The depth of the recess **13** is such as to receive the spoiler flap **14**, presently to be described, when the spoiler retracts into the recess, as will be hereinafter made clear. While the spoiler flaps **14** are shown as being of generally rectangular form it will be understood that they may have any suitable configuration.

Referring to FIG. **2**, at the leading edge of the recess **13** is an anchor slot as at **16**, extending substantially the

full length of the recess. This slot, which penetrates through the thickness of the blade **12,** serves to secure the spoiler flap **14** in the blade. It will be understood that the geometry of the slot may take any desired form so long as it serves to securely anchor the spoiler flap to the blade.

The spoiler flap **14** is formed preferably of an elastomeric material, such as urethane rubber (diisocyanate polyester). The spoiler flap **14** may be produced by any suitable method, such as compression molding. FIGS. **7** and **8** illustrate one form of spoiler as fabricated and prior to installation in a propeller blade. The spoiler flap **14** includes a generally rectangular upper portion **17,** an intermediate grooved portion **18** and a lower leader portion **19** which is preferably tapered at its side edges and on opposite surfaces. The spoiler flap **14** is installed in a manner, as will be hereinafter described. The grooved portion **18** provides a region of reduced thickness which functions as a hinge. The performance of the spoiler flaps **14** is determined by the thickness and width of the hinge region **18,** the hardness or modulus of flexure of the material from which the spoiler is fabricated, the length and height of the exposed portion of the spoiler flap and the initial angle which the spoiler flap assumes when the propeller is at rest.

FIGS. **3–6** show the deployment of the spoiler flaps **14** under various conditions of operation. When the propeller **10** is at rest, each spoiler flap **14** normally is inclined in the direction of the leading edge of the blade and assumes the forward-leaning position illustrated in FIG. **3,** with the plane of the spoiler flap assuming an angle α with the plane of the blade **12.** At low forward speeds of the propeller, the spoiler flap bends under the influence of hydrodynamic momentum and angle α decreases as shown in FIG. **4.** It is possible to design the spoiler flaps so that they deploy at right angles to the flow (for maximum effect) at an engine speed just above stall speed. In this mode the spoiler flaps will reduce hull speed by approximately 50 percent below the speed achieved by a standard propeller having similar design characteristics and operating at the same engine speed. At intermediate speeds and higher speeds, hydrodynamic momentum causes the spoiler flaps **14** to retract completely into their respective recesses, as shown in FIG. **5.** Thus, at intermediate and higher speeds of the outboard motor the flow past the propeller is not impeded and the performance of the engine compares favorably to that of a conventional propeller of corresponding design. In reverse operation, the spoiler flaps fold in an opposite direction, substantially as illustrated in FIG. **6,** and their effect upon thrust and hull speed are negligible.

Numerous tests have been made to compare conventional propellers with units modified in accordance with my invention. The tests were made in sea water with a boat 14 feet in length fitted with an engine rated at 7½ horsepower and having a 7½ inch diameter three-bladed propeller with an eight inch pitch. In the propellers embodying my invention, anchor slots were machined in each blade approximately ahead of the trailing blade slot **20** with a forwardly inclined angle such that the initial angle of the spoiler flap, at rest, was 135° in relation to the blade. Each spoiler flap was formed of urethane, 3/32 inch thick having a durometer hardness of 95 on the Shore "A" scale and the following dimensions: length 1.5 inch, height 0.8 inch, hinge thickness 0.065 inch and hinge width 0.125 inch.

At an engine speed of 700 rpm, considered the acceptable minimum for operation of the particular engine, my propeller reduced the speed of the boat by 50 percent, from 1.0 knot to 0.5 knot. At 1,500 rpm and above, the spoiler flaps were fully retracted into their respective recesses and the performance of my propeller conformed substantially to that of the conventional propeller. At full throttle with an engine speed of 5,050 rpm the boat attained a speed of 9.7 knots. With a conventional propeller operating at a speed of 5,150 rpm, the boat attained a speed of 10.0 knots. Thus my propeller attained 97 percent of the top speed achieved by the standard propeller.

As indicated above, since the spoiler flap **14** may be formed by compression molding, it need not be flat as shown in FIG. **7.** In fact it is possible and is sometimes advantageous to mold the spoilers with a bend at the hinge region as indicated in FIG. **8** such that the flap portion **17** has a natural tendency to lean forward when the propeller is at rest. This alternate spoiler configuration eliminates the necessity for tilting the slot **16** to cause the spoiler flap to assume the desired initial inclination in relation to the blade. In some cases this expedient may reduce the overall manufacturing cost by simplifying the formation of the anchor slot.

In installing a spoiler flap **14** on a blade **12** the tapered leader portion **19** is inserted into the blade slot **16** and drawn through to the point where the lower edge **18***a* of the hinge portion **18** coincides with the forward edge of the recess **13.** The spoiler flap **14** is securely gripped by interference with the slot **16** and the excess portion of the leader **19** which extends beyond the slot **16** may be trimmed away, as with a knife or other suitable implement, so that the anchor of the spoiler flap is flush with the non-thrusting surface of the blade **12.**

In the alternative embodiment illustrated in FIG. **9** the propeller **10***a* is substantially similar to that hereinabove described, except that in this instance, the hub **11***a* is provided with a plurality of recesses **13**a in the surface thereof. Said recesses are preferably formed in the casting operation for the propeller. Adjacent the leading edge of each recess there is provided an anchor slot **16***a* which serves the same purpose as the anchor slots previously described. The spoiler flaps **14***a* which are anchored in their slots in a manner similar to that used to anchor the blade spoilers, are constructed substantially as hereinabove described. Because of the structure of the hub **11***a*, the recesses **13***a* and spoiler flaps **14***a* are generally triangular rather than rectangular. As in the first described embodiment, the spoiler flaps normally incline into the direction of rotation of the propeller and present their maximum area to impede propeller at minimum engine speed. It has been found in the operation of this alternate embodiment that the use of recesses on the hub surface to receive the spoiler flaps, at intermediate and high speed operations of the propeller, is not an absolute necessity, since experiments have shown that at high speeds the flow past the propeller is not materially impeded even when the spoiler flaps do not lie flush with the surface of the hub.

Various changes coming within the spirit of my invention may suggest themselves to those skilled in the art; hence, I do not wish to be limited to the specific

embodiments shown and described and uses mentioned, but intend the same to be merely exemplary, the scope of my invention being limited only by the appended claims.

I claim:

1. In combination, a marine propeller having a body including a hub and a plurality of blades connected to the hub, said body having a plurality of spaced slots in selected body portions with said slots extending through said body portions, a hydrodynamic spoiler flap anchored in each of said slots and normally biased to extend laterally of the surface of each respective body portion, each of said spoiler flaps being formed of elastomeric material and having an area of reduced thickness constituting a hinge portion adjacent to and co-extensive in length with a respective slot, the surface of each body portion having a recess adjacent and in trailing relation to a respective slot, each recess being substantially co-extensive in area with each flap to accommodate the flap in substantially flush relationship with the body portion, each slot being formed with a forward leaning angle such that when the propeller is at rest the flaps are inclined into the direction of normal flow which exists when the propeller is rotated in its normal forward direction, each of said flaps being arranged to assume different angular relationships progressively approaching a respective recess as the rotational speed of the propeller progressively increases.

2. The invention as defined in claim **1** in which the selected body portions are located on the propeller hub.

3. In combination, a marine propeller having a body including a hub and blades connected to the hub, each of said blades having a slot extending through said blade, a hydrodynamic spoiler flap anchored in each of said slots and normally biased to extend laterally of the surface of each respective blade, each of said spoiler flaps being formed of elastomeric material and having an area of reduced thickness constituting a hinge portion adjacent to and co-extensive in length with a respective slot, the surface of each blade having a recess adjacent to and in trailing relation to a respective slot, each recess being substantially co-extensive in area with each flap to accommodate the flap in substantially flush relationship with the surface of the blade, each slot being formed with a forward leaning angle such that when the propeller is at rest the flaps are inclined in the direction of normal flow which exists when the propeller is rotated in its normal forward direction, each of said flaps being arranged to assume different angular relationships progressively approaching a respective recess as the rotational speed of the propeller progressively increases.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,812,812 Dated May 28, 1974

Inventor(~~s~~) Mathew Hurwitz

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE SPECIFICATION:

Column 3, line 60, after "approximately" insert --35°--

Signed and sealed this 8th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents