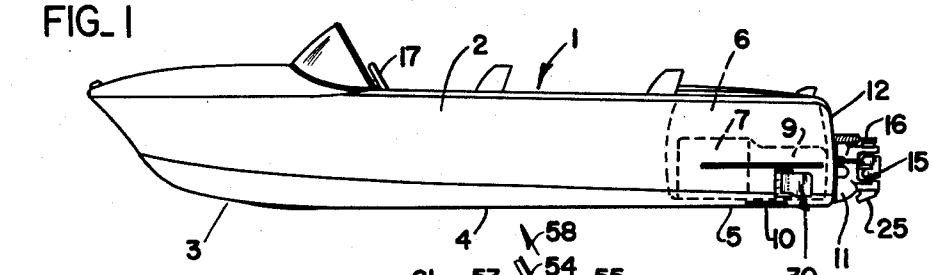
Dec. 1, 1964 F. E. WINNEN 3,159,134

SLOW SPEED STEERING CONTROL FOR JET PROPELLED BOATS

Filed March 15, 1963

FIG_1



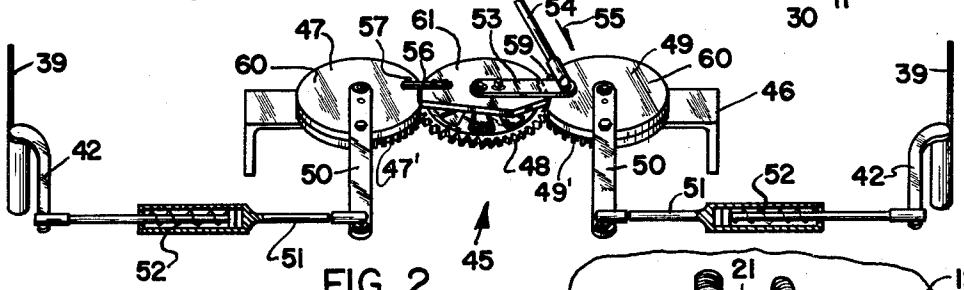
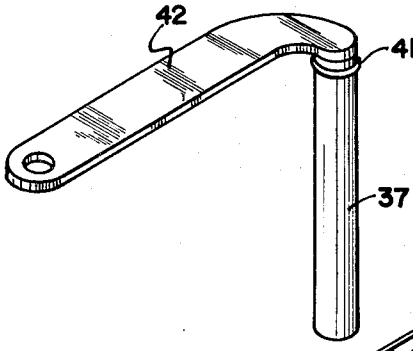


FIG_2



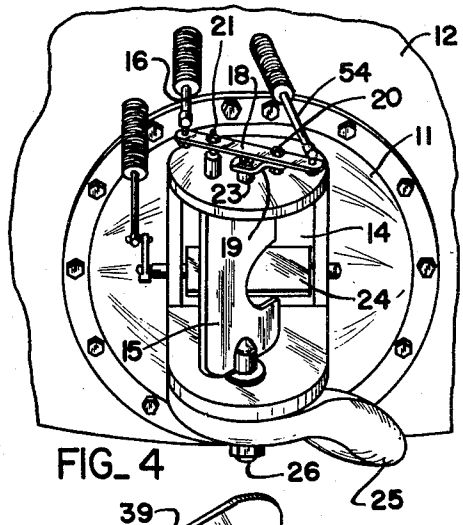


FIG_4

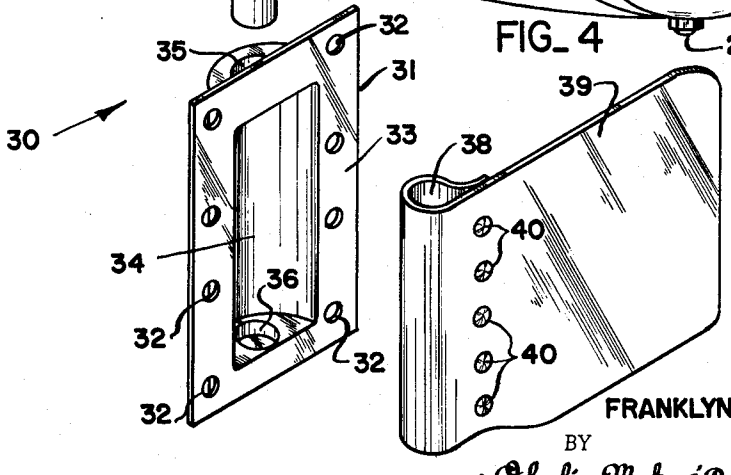


FIG_3

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United States Patent Office 3,159,134 Patented Dec. 1, 1964

3,159,134

SLOW SPEED STEERING CONTROL FOR JET PROPELLED BOATS

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Filed Mar. 15, 1963, Ser. No. 265,520
9 Claims. (Cl. 115—12)

The present invention relates generally as indicated to a slow speed steering control for jet propelled boats.

In jet propelled motor boats, a pump powered by an inboard engine draws in water through an inlet grid flush with the bottom of the hull near the stern, and blasts the water rearwardly out of the stern through a nozzle. For steering, the nozzle itself may be pivotally supported on the transom, or a vane may be thus pivotally mounted at the nozzle outlet to deflect the jet stream from side to side. There is also provided, for reverse propulsion or for braking, a forwardly and downwardly directed nozzle through which the jet stream is diverted as by a gate or butterfly type valve and, if desired, the forwardly and downwardly directed nozzle may be mounted to turn with the aforesaid vane. In either event, at low speeds there is insufficient steering control with such pivoted nozzle or vane. Jet propelled power boats are, of course, ideal for navigation in extremely shallow, or weed-choked waters where a propeller would foul.

Accordingly, it is a principal object of this invention to provide a steering control mechanism for jet propelled power boats which provides effective steering, even at very slow engine speeds and during towing with the engine not running.

It is another object of this invention to provide a steering control mechanism as aforesaid, which imposes no drag when the boat is traveling high out of the water at moderate and high speeds.

It is another object of this invention to provide a steering control mechanism of the character indicated which, while mounted on the sides of the boat, are yieldable in the event of contact of the sides of the hull with a dock, pier, or the like.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

FIG. 1 is a side elevation view of a jet propelled power boat embodying the present invention;

FIG. 2 is a perspective view illustrating a preferred form of slow speed steering control mechanism for the FIG. 1 power boat;

FIG. 3 is an exploded perspective view of one of the rudder and tiller assemblies adapted for mounting on the respective sides of the boat hull near the stern; and

FIG. 4 is a rear perspective view of the jet nozzle showing the jet steering vane and the coupling of the present steering control thereto.

Referring now more particularly to the drawings, and first to FIG. 1, the power boat or runabout 1 herein shown by way of illustrative example only, comprises a hull 2 of molded fiber glass, plywood, aluminum, or the like, and may be a compromise of three basic hull types, namely, flat, round and V-bottom. Herein, the bow section 3 has a V-bottom for cutting through waves without

pounding, the midships 4 may be partly V-bottom and round bottom for easy motion in the water, and the stern section 5 is essentially flat bottom for lift and stability. When this type of power boat 1 reaches a moderate speed it climbs out of the water and planes along with essentially only its flat stern 5 riding in the water and at low speeds, it will displace only a few inches of water. Accordingly, by reason of the jet propulsion (no rudder, and/or propeller projecting below the bottom of the hull), this boat 1 may navigate very shallow water and drag is negligible.

Within the stern compartment 6 is an inboard engine 7 which may, for example, be a 180 H.P. V–8 marine engine which powers a pump 9 also in the stern compartment, the pump 9 having an inlet grid 10 flush with the bottom of the stern section 5 and having its housing and the nozzle housing 11 secured on opposite sides of the transom 12. The engine 7 may have its own water pump for cooling, or a portion of the jet pump output may be diverted for circulation through the engine block. The jet nozzle housing 11 projects rearwardly from the middle of the transom 12, and provides an outlet 14 for discharge of a powerful stream of water rearwardly which, by reaction, propels the boat 1 forwardly. For steering, the jet stream from outlet 14 is deflected from side to side by a vane 15 which is turned about a vertical axis through cables or the like 16 coupled with the steering wheel 17 and with the vane 15 as by links 18 and 19 pivotally connected together by pin 20 with link 18 mounted on pivot 21 of housing 11 and with link 19 keyed on the upper shaft portion 23 of vane 15. Upstream of the vane 15 there is provided a gate or butterfly valve 24, swingable about a horizontal axis to close the jet outlet 14 and to divert the water so that it emerges from the downwardly and forwardly directed reversing or braking nozzle 25, said nozzle 25 being mounted on the lower shaft portion 26 of vane 15 for turning therewith.

The jet steering arrangement thus far described, or when comprising a pivoted jet nozzle, leaves much to be desired at low speeds, since the jet stream velocity is correspondingly low.

Accordingly, the present invention has been devised to provide a good steering control for a jet propelled power boat 1 even at very slow speeds, or even when the engine 7 is not running and the boat 1 is being towed. In the latter instance, the novel steering control herein may be useful for steering of towed inboard or outboard propeller-driven craft.

As best shown in FIG. 3, and also in FIG. 1, there is mounted on each side of the hull 2 at the stern section 5, a rudder assembly 30 which comprises a recessed bracket 31 secured to the side of the hull as by suitable rivets or screws through the holes 32, with a suitable gasket (not shown) clamped between the side of the hull 1 and the flange 33 of the bracket. Projecting through the side of the hull to the inside of the stern compartment 6 is the recessed portion 34 having an opening 35 at the upper end, and a blind socket 36 at the lower end for receiving the rudder bar 37 which extends through the loop portion 38 provided at the leading edge of the rudder 39. The rudder 39 is nonrotatably mounted on the rudder bar 37 by suitable means such as the screws 40 which tightly contract the loop portion 38 about the rudder bar and, of course, pins, keys, setscrews or the like, may be employed to securely lock the rudder 39 to rudder bar 37. The upper end of the rudder bar 37 has a peripheral groove in which is disposed a suitable packing ring 41 of rubber-like material, which forms a water-tight seal in the opening 35. Secured to the upper end of the rudder bar 37 is a tiller 42 by which the rudder 39 may be swung outwardly from a position substantially flush with the side of the hull 2.

The rudder assembly 30 shown in FIGS. 1 and 3 and that on the other side of the hull 2 are allochiral.

Referring now to FIG. 2, there is secured within the stern compartment 6a steering mechanism 45 for selectively turning the rudders 39 from their substantially flush positions to angularly outward positions to effect steering control in one direction or the other. That mechanism comprises a bracket 46 upon which are rotatably mounted three gear units 47, 48, and 49 of which the two outer ones 47 and 49 have forwardly extending arms 50 of which the ends are liked to the ends of the respective tillers 42 by spring links 51 which comprise telescoped sections with springs 52 therebetween to permit inward swinging of the respective rudders 39 in the event that one side or the other of the hull 2 moves against the side of a dock, pier, or the like. The outer gear units 47 and 49 are provided with gear segments 47' and 49', respectively, projecting radially outwardly therefrom over approximately one-fourth of their respective outer peripheries, such gear segments 47' and 49' being so disposed on the gear units that when the rudders 39 are in the flush or in position, the teeth of both of the gear segments are out of engagement with the teeth of the middle gear 48. To establish engagement between the teeth of the left gear segment 47' and the teeth of the middle gear 48 so as to swing the left rudder 39 to the out position, it is necessary to move the middle gear 48 in a clockwise direction to cause the bar 56 thereon to engage the pin 57 of the left gear 47 and cause counterclockwise rotation of such left gear until the teeth of its gear segment 47' mesh with the teeth of the center gear 48. Subsequent rotational movement of the center gear 48 in the opposite direction causes rotational movement of the left gear 47 in a clockwise direction until the left rudder 39 is again in the flush position, at which time one end of the gear segment 47' is reached. Thus, continued rotational movement of the middle gear 48 in this counterclockwise direction has no further effect on the left gear unit 47, but such continued movement does cause the arm 53 on the middle gear 48 to engage the pin 59 on the right gear unit 49 to cause the same to rotate in a clockwise direction until the teeth of its gear segment 49' mesh with the teeth of the center gear and consequently drive the right rudder 39 to the out position. The inward movement of such right rudder is then effected by again rotating the center gear in the opposite direction, such right rudder 39 reaching the flush position when the center gear reaches one end of the gear segment 49' of the gear unit 49.

The middle gear 48 has a sidewardly extending arm 53 to which is connected a rearwardly extending link 54 which extends through the transom 12 and is pivoted on the vane turning link 18 (see FIG. 4) which is controlled by the steering wheel 17. When the vane 15 is straight, the link 54, arm 53, and center gear 48 will be in the position shown in FIG. 2, and since the center gear 48 is thereby held against turning, both rudder assemblies 30 will be held in their straight positions substantially flush with the sides of the hull 2. Furthermore, at cruising speeds of the boat 1, the rudders 39 will be above the waterline, and thus turning of the boat 1 at high speeds will be determined solely by the position of the vane 15.

On the other hand, at slow speeds, the hull 2 will sink in the water several inches, as aforesaid, whereby the rudders 39 will be submerged so that when the steering wheel 17 is turned to turn the vane 15, the link 18 will pivot about shaft 21 to move the link 54 forwardly or rearwardly. If the link 54 is moved forwardly, as denoted by the arrow 55, the center gear 48 is turned clockwise, whereby the bar 56 thereon, in engaging the pin 57 of the left gear 47 as aforesaid, causes counterclockwise rotation of the left gear 47 until the teeth of its gear segment mesh with the teeth of the center gear 48. As apparent, such counterclockwise rotation of the left gear 47 will pull the spring link 51 toward the right to swing the left rudder 39 outwardly to thus turn the boat 1 in one direction.

When the link 54 is moved in the opposite direction, that is, rearwardly, as denoted by the arrow 58, the center gear 48 is turned counterclockwise and the arm 53, in engaging the pin 59 of the right gear 49, causes clockwise rotation of the latter so that the teeth of its gear segment mesh with the teeth of the center gear 48. Such clockwise rotation of the right gear 49 pulls the spring link 51 toward the left to cause outward swinging of the right rudder 39 with consequent steering of the boat in the opposite direction from that described in connection with the swinging out of the left rudder 39.

It is to be noted that the left and right gears 47 and 49 have plates 60 thereon which are arcuately notched to interfit with the partial plate 61 fixed to the center gear 48, whereby when the parts are in the position shown, both rudders 39 are locked against outward swinging. Thus, the rudders 39 are swung out or in, due to rotation of the center gear 48 in one direction or the other meshing with the teeth of the gear segments of one or the other of the left and right gears 47 and 49.

If the boat 1 is traveling at low speed corresponding to a low engine speed, good steering control is obtained by the rudders 39 then submerged in the water. Furthermore, if the engine speed is increased with increased jet stream velocity, sharp turns may be made with the rudders 39 submerged, but as the boat 1 reaches a certain speed it will climb out of the water with only its flat stern 5 riding in the water with the rudders 39 above water, whereby actuation of the rudders 39 at that time has no effect on steering and, moreover, are not required for steering at high speeds.

It is to be understood that, if desired, means may be provided to deactivate the slow speed control mechanism 45 when not needed. For example, when the reverse or braking nozzle 25 is being used, it may not be desirable to have one or the other of the rudders in outwardly swung position, although they would influence steering in reverse.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A steering control mechanism for a jet propelled boat of the type having a substantially flat, unobstructed bottom at its stern for navigation in shallow waters, and a jet nozzle and associated steering means operative to discharge a stream of water rearwardly; said mechanism comprising a rudder on each side of said boat near its stern; first means mounting each rudder for outward swinging movement from a position substantially flush with the side of said boat; and second means for selectively swinging said rudders as aforesaid, said second means including spring and linkage means disposed within said boat permitting yieldable inward swinging movement of the respective rudders toward their flush positions upon engagement with a rigid member.

2. A steering control mechanism for a jet propelled boat of the type having a substantially flat, unobstructed bottom at its stern for navigation in shallow waters, and a jet nozzle and associated steering means operative to discharge a stream of water rearwardly; said mechanism comprising a rudder on each side of said boat near its stern; first means mounting each rudder for outward swinging movement from a position substantially flush with the side of said boat; and second means for selectively swinging said rudders as aforesaid, said second means comprising a support in a stern compartment of said boat, and gear and link means on said support including a first gear turnable in opposite directions, and other gears linked to the respective rudders

and selectively meshed with said first gear according to the direction of turning of the latter.

3. The steering control mechanism of claim 2 wherein said other gears have plates thereon which are arcuately notched to interfit with a partial plate fixed to said first gear so as to preclude outward swinging movement of said rudders except when there is engagement between said first gear and said other gears.

4. A steering control mechanism for a jet propelled boat of the type having a substantially flat, unobstructed bottom at its stern for navigation in shallow waters, and a jet nozzle and associated steering means operative to discharge a stream of water rearwardly; said mechanism comprising a rudder on each side of said boat near its stern; first means mounting each rudder for outward swinging movement from a position substantially flush with the side of said boat; and second means for selectively swinging said rudders as aforesaid, said second means comprising a support in a stern compartment of said boat, and gear and link means on said support including a first gear turnable in opposite directions, and other gears linked to the respective rudders, said other gears being provided with gear segments which project radially outwardly from only a portion of their respective outer peripheries, said gear segments being out of engagement with said first gear when said rudders are in said flush position, and means for establishing engagement between said first gear and one or the other of said gear segments according to the direction of turning of said first gear.

5. The steering control mechanism of claim 4 wherein said last mentioned means comprises a pin mounted on each of said other gears, one pin of which is adapted to be engaged by a first arm projecting radially outwardly from said first gear when said first gear is rotated in one direction, and the other pin of which is adapted to be engaged by a second arm projecting radially outwardly from said first gear when said first gear is rotated in the opposite direction.

6. A jet propelled boat and low and high speed steering control mechanisms therefor comprising a hull having a generally flat bottom at its stern section for planing of said hull at relatively high speeds; an engine driven pump in said hull having an inlet which opens through the bottom of said stern section and an outlet in the form of a jet nozzle and associated high speed steering mechanism through which a stream of water is discharged rearwardly for propelling said boat forwardly by reaction of said stream; a rudder on each side of said hull near the stern thereof and disposed respectively

above the water line when said boat is propelled at high speeds and submerged in the water when said boat is propelled or towed at low speeds; first means mounting each rudder for outward swinging movement from a position substantially flush with the side of said hull; and second means for selectively swinging said rudders as aforesaid so as to constitute a low speed steering control for said boat while said rudders are submerged, said second means including spring and link means disposed within said boat permitting yieldable inward swinging movement of the respective rudders toward their flush positions upon engagement with a rigid member.

7. A jet-propelled boat and low and high speed steering control mechanisms therefor comprising a hull having a generally flat bottom at its stern section for planing of said hull at relatively high speeds; an engine driven pump in said hull having an inlet which opens through the bottom of said stern section and an outlet in the form of a jet nozzle and associated high speed steering mechanism through which a stream of water is discharged rearwardly for propelling said boat forwardly by reaction of said stream; a rudder on each side of said hull near the stern thereof and disposed respectively above the water line when said boat is propelled at high speeds and submerged in the water when said boat is propelled or towed at low speeds; first means mounting each rudder for outward swinging movement from a position substantially flush with the side of said hull; and second means for selectively swinging said rudders as aforesaid so as to constitute a low speed steering control for said boat while said rudders are submerged and wherein said second means comprises a support in a stern compartment of said boat; and gear and link means on said support including a first gear turnable in opposite directions, and other gears linked to the respective rudders and selectively meshed with said first gear.

8. The steering control mechanism of claim 2 wherein said first gear is operatively coupled with the steering mechanism associated with said jet nozzle.

9. The jet-propelled boat and low and high speed steering control mechanisms of claim 7 wherein said first gear is operatively coupled with said high speed steering mechanism.

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