Oct. 1, 1963 P. R. BALDWIN 3,105,454

BOAT PROPULSION SYSTEM

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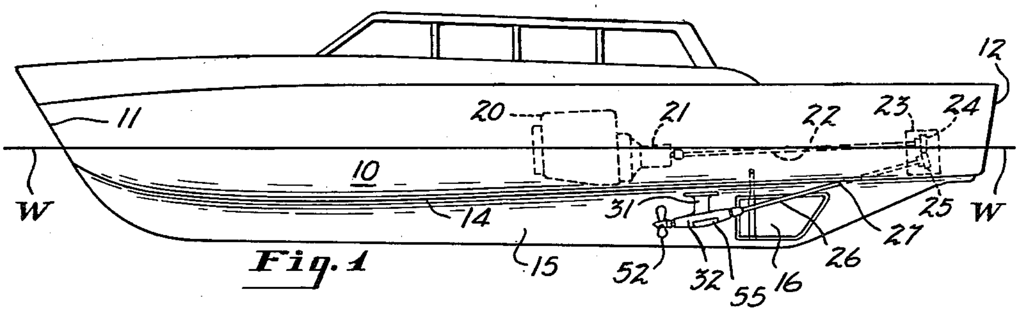

Fig. 1

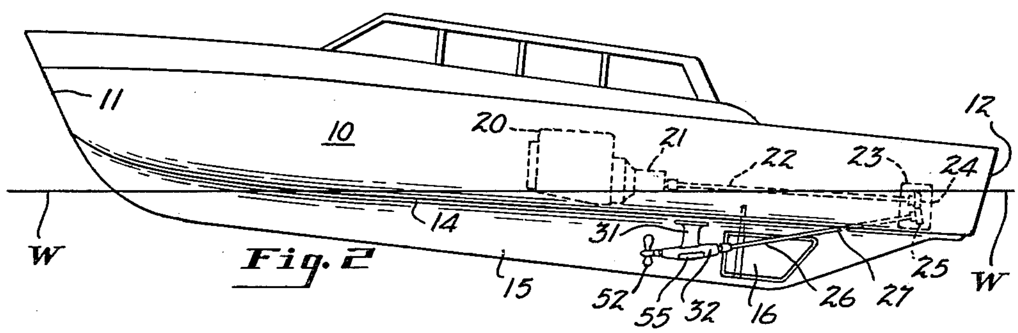

Fig. 2

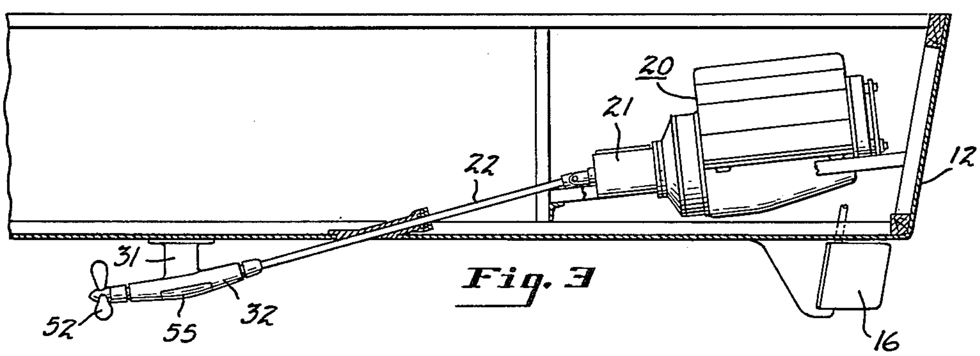

Fig. 3

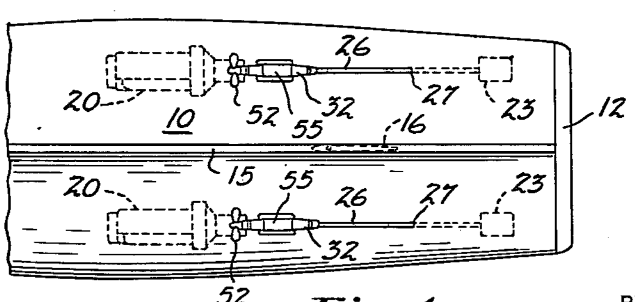

Fig. 4

INVENTOR
Paul R. Baldwin

BY *J. W. Douglass*
His ATTORNEY

BOAT PROPULSION SYSTEM

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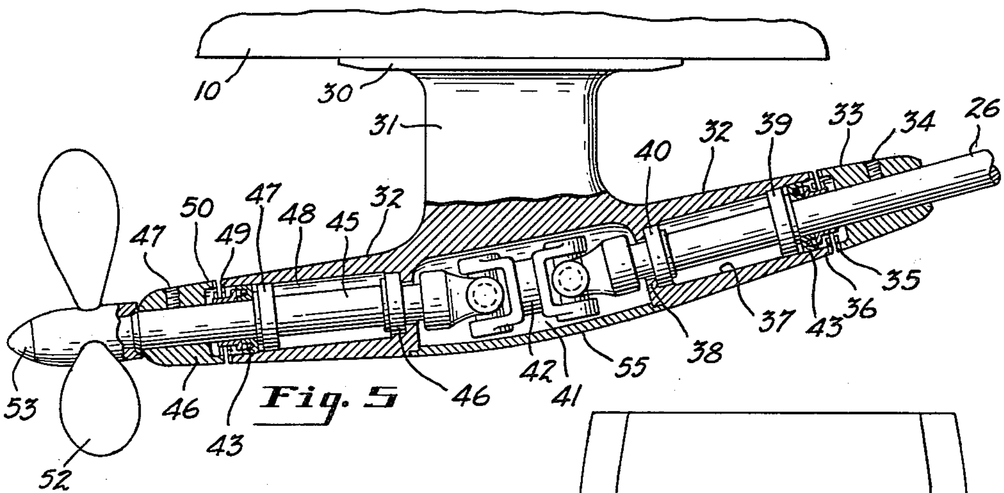

Fig. 5

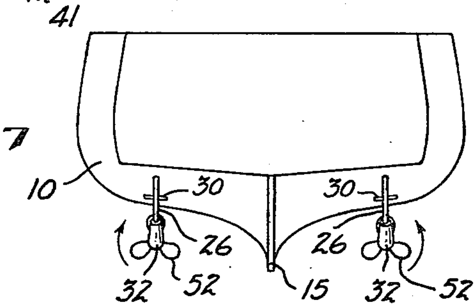

Fig. 7

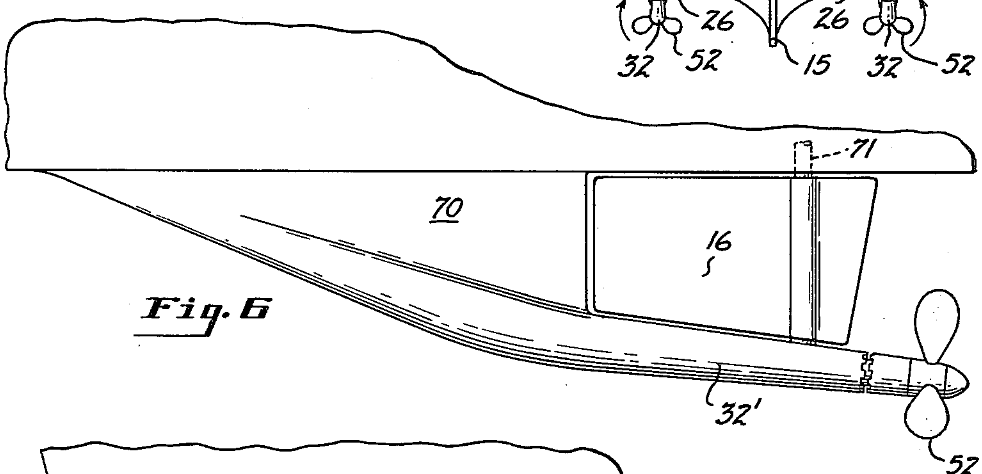

Fig. 6

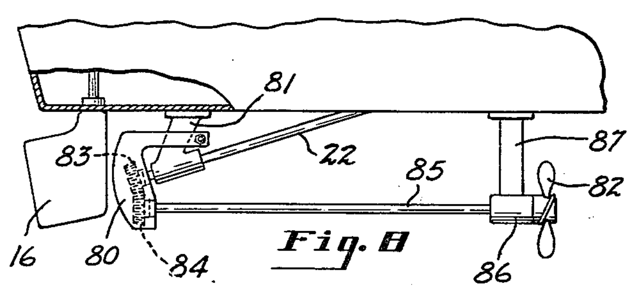

Fig. 8

INVENTOR
Paul R. Baldwin

BY J. W. Douglas
His ATTORNEY

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3,105,454

BOAT PROPULSION SYSTEM

Paul R. Baldwin, State Rte. 252, Valley City, Ohio
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2 Claims. (Cl. 115—34)

This invention relates to improvements in boat propulsion systems. It is a continuation-in-part of my co-pending application Serial No. 859,035, of December 11, 1959.

Heretofore it has been common practice to propel boats by means of a bladed propeller or propellers of the pusher type commonly called screw propellers, which are disposed below the water line at the stern of the boat. The motive power is usually one or more internal combustion engines disposed forward of the stern, usually amidship, and connected by a transmission and drive shaft to the propeller. It is customary for the drive shaft to extend through a suitable water-tight seal in the bottom of the hull at an angle. The result is that the axes of the propeller is usually at an angle which slants downward and rearward.

In such a system, when the boat comes up to cruising speed, the bow rises and the entire angle of the attack of the boat is increased. The angle of the axis of the propeller relative to the surface of the water is also increased. The result is that a portion of the propeller effort is tending to push the entire boat out of the water and this power, which should be used to drive the boat forward, is wasted.

In such boats, the rudder or rudders are usually immediately to the rear of the propeller and the force of the water backward alongside the rudders causes a stiffening effect thereon that increases the effort required for steering and also causes the steering to be sluggish.

At higher speeds, the wake of the vessel causes a trough where the propellers operate and it is not uncommon for the blades to break through the water, resulting in a racing of the engine which is damaging thereto. When the propellers break through periodically both they and the engine are subjected to alternate periods of load and no load which causes acceleration and sudden load pitching that is damaging to the boat as well as being undesirable to the occupants. In rough seas the stern of the boat may rise, due to the pitching as it rides on the crest of a wave, and the propeller then breaks through and races. This also results in a temporary loss of control because neither the propellers or the rudder are in the water. It also presents a loss of stability previously mentioned. Should only one propeller break through, the boat veers to the port or starboard.

By the present invention I have provided a propulsion system where the steering ability is made easier and more effective. The power of the propellers is utilized in such a manner that substantially all the effort is used to pull the boat forward and little, if any, effort wasted in trying to push the boat out of the water. The propellers are so positioned that the force of the water backward under the boat has a stabilizing influence on the boat, materially lessening the rolling and pitching of the boat even in high seas. The propellers do not have the tendency to break water due to the passage over crests, or due to the wake of the boat, or to cause cavitation such as is common in conventional stern drives.

Furthermore the boat, at cruising speed, has a much less rise of the bow but rises higher in the water from bow to stern. The first provides greater visibility and greater comfort for the occupants and the second provides greater buoyancy for the boat and less draft and decreased resistance to the water.

Since the propellers are enabled to operate at their peak efficiency, engine speed may be reduced which re-

sults in longer engine life and decreased fuel consumption and decreased cavitation and erosion of the propellers.

Still other advantages of the invention and the invention itself will become more apparent from the following description of an embodiment of the invention and which is illustrated by the accompanying drawings and forms a part of the specification.

In the drawings:

FIG. 1 is a side elevational view of a boat embodying my new drive, illustrating the boat at rest and showing in dashed lines the placement of the engine and the drive shafts;

FIG. 2 is a view of the same boat at cruising speed;

FIG. 3 is a fragmentary diagrammatic view of a boat showing an engine mounted in the rear;

FIG. 4 is a fragmentary bottom plan view of the boat of FIGS. 1 and 2;

FIG. 5 is an enlarged view of the propeller support broken away to show a form of interior construction;

FIG. 6 is a fragmentary elevation of another form of propeller and rudder support;

FIG. 7 is a diagrammatic stern elevational view of a boat illustrating the placement of the propellers; and

FIG. 8 is a fragmentary elevation view of an attachment which may be used for converting ordinary boats to the drive of the invention.

Briefly, the invention contemplates the use of tractor propellers that pull the boat rather than push it, and which are hereinafter referred to as tractor propellers. In addition, the propellers are placed under the boat, away from the stern, and although the exact position may be varied, preferably are placed slightly aft of the mid section of the boat or about one-third of the boat length forward from the stern. The propellers have their axes inclined downward when the boat is at rest and the inclination is such that when the boat comes up to cruising speed the rise of the bow causes the axes of the propellers to be substantially parallel to the surface of the water.

Referring now to the drawings, throughout which like parts have been designated by like reference characters and particularly to FIGS. 1 and 2, there has been illustrated a conventional form of cabin cruiser which includes the hull 10, having a bow 11, and a stern 12. The bottom of the hull is at 14 and a keel 15 is provided, in the usual manner, extending along the longitudinal midline of the hull from the bow to the stern. Although the keel is illustrated slightly deeper than most keels, it may be of conventional design. An imaginary water line is indicated at W.

Interiorly of the boat there is provided the usual engines 20, each having a clutch and reversing transmission 21. Each drive shaft 22 extends to the rear and into a gear box 23 which contains an upper driving gear 24 and a lower driving gear 25. Other types of gear box and gearing may be used so long as it may be driven from a shaft such as 22 and can drive a shaft 26 which extends from the gear box forward and downward, through a suitable water tight bearing located at 27, through the bottom of the hull.

The forwardly and downwardly inclined driven shafts 26 each connect to a propeller support and shaft angle changing device, shown in detail in FIG. 5. This support includes a base flange 30 the upper surface of which is contoured to fit the underside of the hull at the place of attachment and is secured to the bottom of the hull by suitable bolts, not shown. A strut 31 extends downward from the base 30 and carries at its lower end an elongated housing 32. Preferably the strut should be of streamlined cross section so that it provides no undue turbulence of the water through which it passes.

The shaft 26 is provided with a spinner cone 33 which is secured to the shaft, by one or more set screws 34, and revolves with the shaft. The front of the cone is provided with weed cutting blades 35 which cooperate with similar blades 36 on the rear end of the housing 32. The rear end of the housing, which is of generally tubular form, is provided with a bore 37, the forward end of which terminates in an inwardly extending apertured wall 38. A first bearing 39 is provided toward the rear end of the bore and a forward bearing 40 is seated on a seat adjacent the wall 38. The shaft 26 is journalled in the bearings and the forward end extends into a chamber 41 and has its end secured to a yoke of a universal joint 42. A water seal 43 is provided at the rearmost end of the housing outward of the bearing 39.

The universal joint 42 may be of the double joint type, and the forward end connects to a propeller shaft 45 which is journalled in bearings 46 and 47 in a bore 48 similar to bore 37. The forward end of the housing is likewise of generally tubular formation. A water seal 43 is likewise provided for the front end of the housing.

The propeller shaft 45 extends beyond the end of the housing and has a spinner cone 46 secured thereto by one or more set screws 47. The adjacent ends of the spinner cone and the forward end of the housing are likewise provided with weed cutting teeth 50 and 49. The end of the shaft 45 is of conventional formation for receiving and having secured therein a three blade tractor screw propeller 52 held in place by the usual nut 53.

It will be noted that the two forward and rearwardly extending tubular parts of the housing 32 are so arranged that the drive shaft 26 comes in at one angle and the propeller shaft 45 leaves at a slight different angle. This is effected by use of the universal joint 42 which may incidentally be either a single or a double joint. Access to the joint compartment 41 may be had through an opening in the bottom of the housing which is closed by a removable plate 55. The plate is sealed in place with suitable gaskets and held in position by screws, not shown. The ultimate angle of the propeller shaft 45 and hence the angle of the axis of the propeller to the surface of the water when the boat is at rest, should be such that at cruising speed the axis of the propeller is parallel to the surface of the water. It is apparent that for boats of different hull design the amount of angularity may vary. As explained in my copending application, means may be provided operated from the interior of the boat whereby the angle may be varied to provide the desired angle.

As best shown in FIG. 7, the two propellers are disposed equidistant from the keel on opposite sides thereof. Here again, the exact spacing from the hull and keel may vary, depending upon the particular design of the hull. It is pointed out that the drive is adaptable to boats which may have substantially no keel at all, such as flat bottom boats and sea sleds.

The preferred location for the propeller should be about one-third of the boat's length ahead of the stern. In some boats, however, it may be desirable to move it farther forward.

When the device is applied to existing boats that have been designed for the usual pushing type propellers, the rudders may be in the standard position as illustrated in FIG. 3. In the boat shown in FIGS. 1 and 2, however, a single rudder 16 has been illustrated which is set into an opening in the keel. Is is suspended and controlled in the usual manner by a tiller or wheel from inside the boat.

In FIG. 6 I have illustrated another type of unit where instead of a rather narrow strut as shown in FIG. 1, the support comprises a main housing in the form of a pair of spaced webs 70 which house the drive shaft. The tube 32′ extends forward and downward from the main housing at an angle with the propeller 52 supported outward of the tube in the same manner as the other embodiment. The bottoms of the spaced webs may be closed. In this instance, however, the space between the tube 32′ and the bottom of the hull or keel is used to house the rudder 16 which is supported on the usual shaft 71.

The placement of the engine or engines in the hull may also vary. Since most of the existing boats have the engine amidship, the design of FIGS. 1 and 2 has been illustrated. This enables boats with conventional drive to be more easily converted to the drive of my invention with a minimum of expense. It may be desirable, however, in some boats and particularly in boats specifically designed for drives of my invention, to place the engine in the stern of the boat, as shown in a more or less diagrammatic manner in FIG. 3. In this instance the gear box 23 for reversing the direction of the shafts is not needed.

It is particularly pointed out that the invention is useful in conjunction with single engine boats as well as double engine boats. Certain additional advantages were obtained from the double engine boats however.

FIG. 8 illustrates the invention in its most inexpensive form as applied to conventional boats. There again, the illustration is more or less diagrammatic. The usual propeller shaft or shafts project rearwardly through the bottom of the hull. The device om my invention contemplates a gear box 80 which may be clamped to the strut 81 which supports the propeller shaft bearing 82. The usual propeller is replaced by a gear 83 on the end of the propeller shaft 22 disposed inside the housing 80, which gear meshes with another gear 84 carried on the end of the driven shaft 85. The driven shaft 85 is supported in a bearing 86, which in turn is supported by a strut 87 secured to the underside of the boat.

In the drawings, the boat is shown in the position it would achieve at cruising speed. At rest the shaft 85 would be inclined downward and forward.

As is well known to those versed in the art, it is most common, in twin engine propeller boats, to have the propeller on the starboard side rotate in a clockwise direction and the propeller on the port side in counter clockwise direction, as viewed from the stern of the boat.

Although the propellers may rotate the same way in the drive of my invention, I believe that an improved mode of operation is realized by causing the starboard propeller to rotate counter clockwise and the port propeller clockwise as shown by the arrows in FIG. 7.

The results of the drive on my invention, from actual tests applied to a 27 foot twin engine cabin cruiser, have proven that the boat which normally cruised at an angle of 12° after conversion cruised at an angle of 6°, with no loss in forward speed and with a reduction in engine speed from 2300 r.p.m. to 2000 r.p.m. The decrease in the angle made the visibility much greater and the pilot and the passengers were much better able to see where they were going. The gasoline consumption was materially reduced. With this boat, which had conventional rudders and with the shaft angle as shown in FIGS. 1, 2 and 5 and the support of FIG. 5, the steering of the boat was extremely easy. So much easier in fact than that of the boat before the conversion, that it could be likened to power steering.

By reversing one propeller, the boat could be made to turn within its own length without headway.

Of particular importance was the fact that in rough seas the propellers at no time were able to break water. This kept them fully submerged and provided a constant bite on the water, with constant forward speed, and no loss of headway, as occurs with conventional drives where the propeller is in the rear.

Another important feature was the fact that the pitching and rolling of the boat was materially reduced and was substantially eliminated in seas up to four foot.

It is believed that the following explanation is a true explanation of why the abovementioned results were obtained. Should it later appear that the theories expressed may be due to a different explanation, I do not wish to be bound thereby.

As to the decrease in the cruising angle. This is due to the fact that, as the boat comes up to cruising speed, the axis of the propeller is parallel to the surface of the water. All of the power is utilized in pulling the boat straight forward and none of the power is wasted in trying to push the boat out of the water.

The elimination of the usual angle of the propeller relative to the surface of the water materially increases the efficiency since the down-going blade and the up-going blade each have the same angle of attack to the water.

The decrease in engine speed was possible because of the position of the propeller which increased its efficiency.

The increase in boat speed with reduced engine r.p.m. is due to the elimination of the angle of the propeller and to the fact that the boat rises higher in the water and has less of an angle of attack. It is also due to the fact that with a tractor type of propeller and with the propeller placed forward from the stern, it obtains an even bite into water that has not been disturbed by wake and which is below the troughs of the waves.

The improvement in the steering is due to the fact that the backwash from the propeller is not striking the rudder and therefore does not have the same stiffening effect as where the propeller is throwing the water back at a high rate of speed on each side of the rudder.

The turning radius of the boat is decreased because the propellers are closer to the center of the boat and when operated in opposite directions, one pushes and the other pulls, which efforts are applied to opposite sides of the boat closer to the widest beam.

The increase in stability is realized because with the tractor propellers the water is being moved backwards under the boat at a relatively high speed. This water flowing under the boat, increases its buoyancy and prevents the boat from pitching and rolling. This effect is increased by the direction of rotation of the propellers since this rotation is such that the water at the tips of the propeller impinges against the hull in a direction inward toward the keel. This provides greater longitudinal stability both in vertical and horizontal directions. It was found that even with one propeller operating the boat did not veer.

In rough seas the pitching and rolling is less because the propeller is always immersed and never breaks water. Even with large waves the propellers do not break water because they are forward of the stern and at or near the natural center of gravity of the boat, whereas in ordinary boats it is the bow and the stern which break from the water most frequently.

It is apparent that the exact placement of the propellers will vary, depending upon the design of the hull. The best position appears to be at least one-third of a boat length ahead of the stern and that if it is at the center of gravity of the boat when it is in the water the probability of the boat ever rising high enough to cause the propellers to

break water is very remote, particularly in boats of the so-called cabin cruiser type.

Having thus described my invention in some embodiments thereof, I am aware that numerous and extensive departures may be made therefrom without departing from the spirit of the invention as defined by the appended claims.

I claim:

1. A boat propulsion system comprising a hull, a pair of bladed tractor screw propellers rotatably mounted under and on opposite sides of the hull and spaced at least one third of the length of the hull ahead of its stern but behind its center of gravity, a keel secured to the bottom of the hull and extending longitudinally thereof, said keel extending downwardly between and below said propellers, the axes of said propellers being parallel to the sides of said keel, inclined forwardly and downwardly when the boat is at rest and extending parallel to the horizon when the boat is cruising and its bow rises, drive means connected to said propellers so as to rotate them in opposite directions and so that the upper blades of opposite propellers move towards one an other and toward said keel whereby water is thrown upwardly against the bottom of said hull, laterally downwardly along opposite sides of said keel and backwardly toward said stern so as to increase stability and improve the riding qualities of the boat.

2. A boat propulsion system as defined in claim 1, wherein said drive means includes a pair of laterally spaced engines mounted within said hull forwardly of its stern, a pair of drive shafts connected to said engines and extending toward said stern, a pair of driven shafts extending downwardly and forwardly through the bottom of said hull, gear means drivingly connecting the rear ends of said drive shafts and driven shafts, housings supported under the hull and the forward end of each of said driven shafts extending into the housings, universal joint means disposed within the housings, said driven shafts connected to said universal joint means, propeller shafts rotatably supported by the housings and drivingly connected to said universal joint means, and said propellers each carried on the forward end of one of said propeller shafts.

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