Nov. 29, 1960 W. R. WOOD 2,961,988

INBOARD PROPULSION UNIT FOR BOATS

Filed March 4, 1958 2 Sheets-Sheet 1

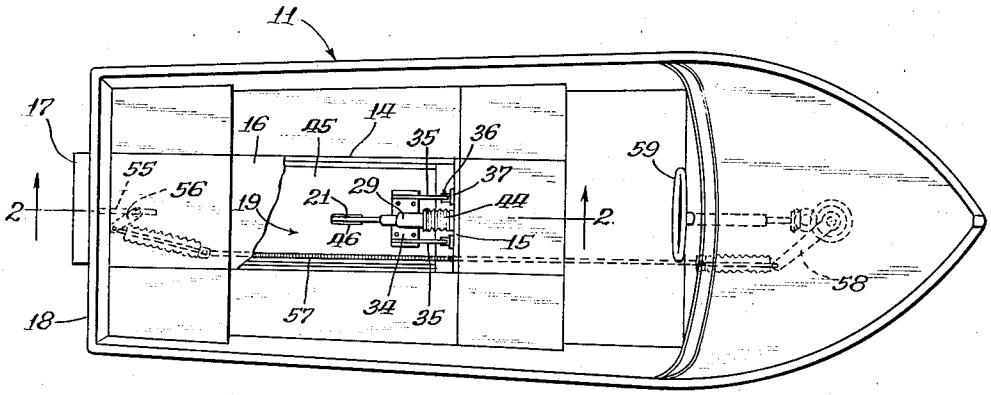


Fig. 1.

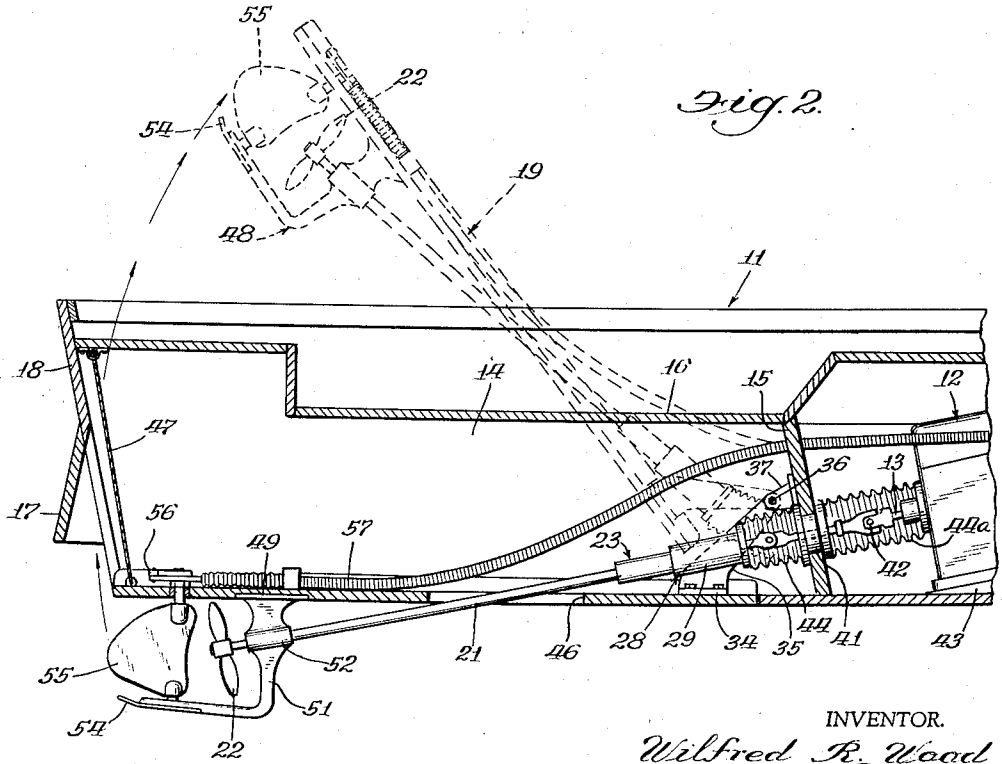


Fig. 2.

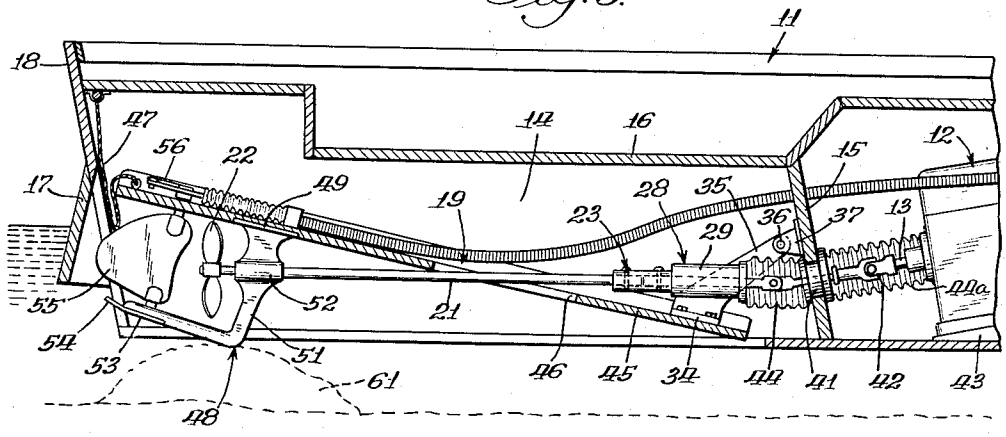
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Fig. 3.



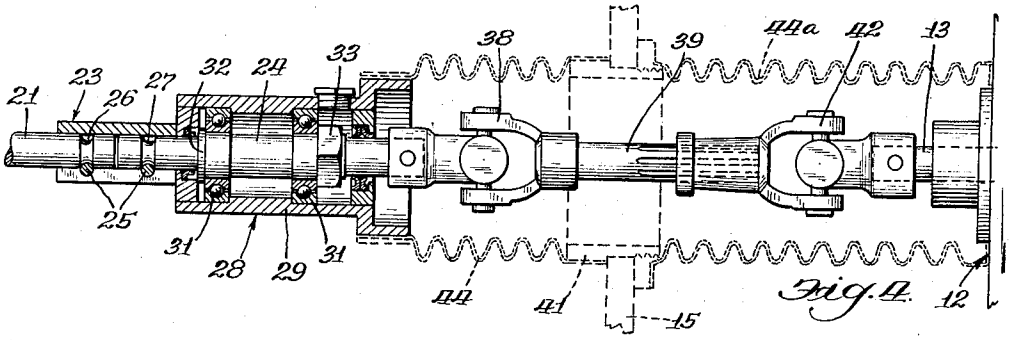


Fig. 4.

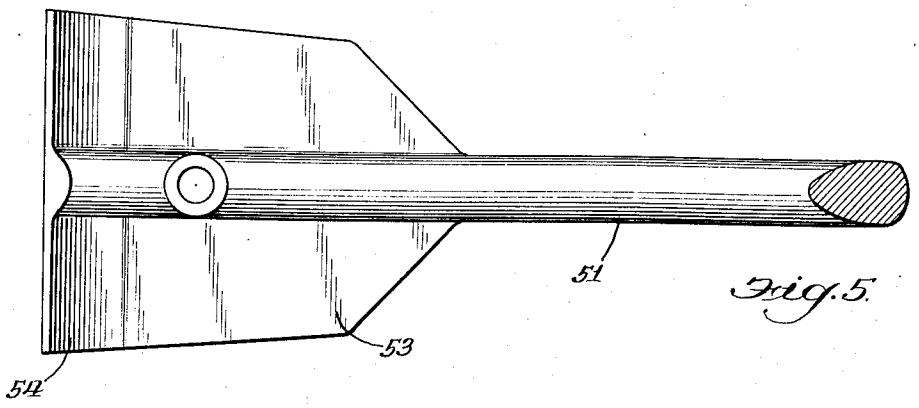
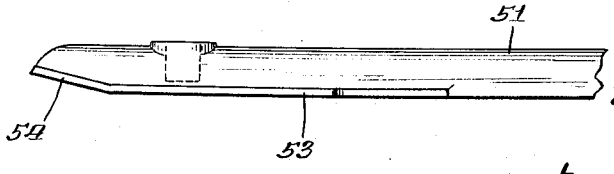


Fig. 5.

Fig. 6.



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INBOARD PROPULSION UNIT FOR BOATS

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8 Claims. (Cl. 115—41)

This invention relates in general to motor boats, and more particularly to an improved propulsion unit for boats with inboard engines.

Such units have been provided heretofore, as that disclosed in U.S. Letters Patent No. 2,742,013, issued April 17, 1956, for the specific purposes of operation in shallow water or where near-surface obstructions may be encountered, and to facilitate cleaning and repair of propeller and rudder from the interior of the boat, by mounting the propulsion unit in a well in the boat so as to enable it to be swung upwardly from a position below the boat to a position above the well in the boat. When mounted and constructed as disclosed in that patent so as to be moved upwardly into a retracted position in the well automatically upon encountering an obstruction, it has been extremely difficult to insure such a unit normally remaining in its lowermost position during operation of the boat, and impossible to assure automatic return to its lowermost position after such an obstruction has been passed, except in response to a very substantial reduction in speed or discontinuance of the application of power for forwardly rotating the propeller.

A principal object of this invention is the provision of such a propulsion unit which normally will maintain itself in its lowermost position, will swing upwardly automatically into a retracted position upon encountering an obstruction, and will return automatically to its lowermost position after the obstruction encountered has been passed or cleared.

Another important object of the invention is to materially improve the boat-propelling operation of such a unit when the same is in retracted position in the well and during reverse rotation of the propeller.

A further object is to simplify and strengthen such a swingable boat propulsion unit so as to minimize the likelihood of damage resulting from operation in shallow water and encountering obstructions.

In the embodiment of the invention herein illustrated, these and other objects that will be understood from this disclosure are severally and jointly obtained by placing the pivot point for the propulsion unit above the axis of the propeller shaft, so that forward thrust by the propeller will be transmitted to the boat as a moment acting to hold the propeller down; employing a downwardly extending strut or bracket, for housing the rear propeller shaft bearing and pivotally mounting the lower end of the rudder, which is provided with a rearwardly and upwardly inclined planing surface rearwardly of the propeller against which rearwardly directed water pressure from the latter will effect a material force component tending to move the rear end of the propulsion unit downwardly; providing a double thrust bearing for the forward end of the propeller shaft that is pivotally mounted on the bulkhead at the forward end of the boat well, so that all of the boat-moving propeller thrust is applied only to that bulkhead; employing, with a boat well having an otherwise open rear end to facilitate effective forward operation when the propulsion unit is in its intermediate raised or obstruction-clearing position, a rearwardly disposed hood which substantially closes the rear end of the well to keep wave motion out of the well when the boat is stopped, is slanted or sloped rearwardly to relieve the water pressure and prevent the rear end of the boat from being sucked down thereby and to deflect the propeller stream downwardly when the propulsion unit is in its intermediate position, and which, during rearward movement of the boat, gives a smoother flow of water to the propeller; and interposing two universal joints between the propeller and engine shafts that are interconnected by a spline arrangement to accommodate the pivotal movements of the propulsion unit.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, when taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

In the drawings:

Figure 1 is a top plan view of a boat embodying the features of the invention, with a portion of the boat well covering removed;

Fig. 2 is a detail vertical section longitudinally of the boat, taken substantially on the line 2—2 of Fig. 1, and showing the propulsion unit in full lines in its lowermost normal operating position and in broken lines in a raised position to provide access to the propeller and rudder from the interior of the boat;

Fig. 3 is a sectional view similar to Fig. 2 showing the propulsion unit in an intermediate operative position within the boat well;

Fig. 4 is a detail horizontal section taken through the double thrust bearing at the forward end of the propeller shaft and showing the connections between the latter and the engine shaft;

Fig. 5 is an enlarged plan view of the rear portion of the propeller shaft supporting strut means to illustrate in detail the planing surface thereof; and

Fig. 6 is a side elevational view of that portion of the strut means shown in Fig. 5.

Referring more particularly to Figs. 1 and 2, reference numeral **11** indicates in general a boat having the propulsion unit of the present invention mounted therein and including an inboard engine **12** having a rearwardly extending drive shaft **13**. The boat **11** is provided with a laterally centrally disposed well at its rear end defined by longitudinally extending side walls **14** and a bulkhead **15** comprising the forward wall. Suitable cover members **16** are removably mounted so as to close the top of the well. The rear end of this well is substantially closed by a hood **17** extending downwardly and rearwardly from above the water line in the central portion of the transom **18**.

A propulsion unit, indicated generally by reference numeral **19**, is operatively connected to the engine drive shaft **13** and pivotally mounted at its forward end so as to be swingable upwardly from its full line position of Fig. 2 through an intermediate operative position in the well, as illustrated in Fig. 3, to an upper servicing position shown in broken lines in Fig. 2 to give access thereto for cleaning and repairing from the interior of the boat. This propulsion unit **19** includes a propeller shaft **21** having a propeller **22** secured in well known manner to its rear end. The forward end of the shaft **21** is connected through a sleeve **23** to the rear end of an intermediate shaft **24** (Fig. 4). To prevent propeller thrust from separating the shafts axially, the sleeve **23**, which is split, is clamped to the shafts by screws **25** and the shafts are grooved at **26** and **27**, respectively, to receive the screws **25**.

The intermediate shaft 24 is carried and rotatably supported by a double thrust bearing indicated generally by reference numeral 28. The bearing 28 includes an outer housing or sleeve portion 29 having two thrust bearings 31 mounted in well known manner therein, for receiving both forward and rearward thrust with a flange 32 on the intermediate shaft 24 engaging the rear thrust bearing 31, and an adjustable screw-threaded collar or nut 33 that is mounted on the shaft 24 engaging the other thrust bearing 31. Packing means 30 of well known construction are employed to seal the ends of the housing 29.

Means are provided for pivotally securing the double thrust bearing 28 to the boat, which includes a bracket comprising a laterally extending base 34 (Figs. 1 and 2) secured intermediate its ends to, or formed integrally with, the housing 29, and upwardly and forwardly extending legs 35 which also are either rigidly secured to, or formed integrally with, the transverse base 34 at their lower ends. The upper end of each of these legs 35 is pivotally secured at 36 by a mounting bracket 37 to the bulkhead 15, the two pivots 36 being axially aligned in a direction extending transversely of the boat. As best seen in Fig. 2, the pivot point 36 about which the thrust bearing 28 and its supporting bracket may swing is disposed in spaced relationship to, and above, the longitudinal axis of the propeller shaft 21. It is preferred that the bearing housing 29 and the base 34 and legs 35 of its supporting bracket be formed as an integral unit, although such is not essential.

The forward end of the intermediate shaft 24, or of the propeller shaft 21 itself, as the case may be, is connected to one end of a universal joint 38 (Fig. 4), the other or forward end of which is pivotally connected to the rear end of a splined shaft 39. This shaft 39 extends loosely through a suitable sleeve fitting 41 (Fig. 3) mounted in well known manner in an aperture in the bulkhead 15, and the forward splined end of the shaft is slidingly connected to a second universal joint 42 (Fig. 4) which is in turn connected in well known manner to the rear end of the engine shaft 13. The two universal joints 38 and 42 and their splined interconnection comprising the shaft 39 facilitate vertical swinging of the thrust bearing 28 and propeller shaft 21 between their several positions of Figs. 2 and 3, while insuring proper power transmission from the engine 12 to the propeller 22 whenever desired, and particularly when in and between the full line operative positions of Figs. 2 and 3. To obtain the most satisfactory normal operation, it is preferred that the engine 12 be mounted on a suitable angularly disposed support 43 (Fig. 2) so that the engine shaft 13 and propeller shaft 21 normally are axially aligned. To protect the universal joint 38 and prevent water leakage from the well through the drive shaft aperture in the bulkhead 15, a tubular accordion sealing boot 44 of any suitable material, such as neoprene, is provided which is sealingly secured at its rearward end to the thrust bearing housing 29 and at its forward end to the sleeve fitting 41. A similar accordion boot 44*a* may be sealingly secured in like fashion surrounding the splined members and the universal joint 42.

Secured to the base 34 of the mounting bracket is the forward end of a relatively thin platform 45 which, when the propulsion unit is in its normal full line position of Fig. 2, is disposed in the plane of the bottom of the boat and substantially closes the bottom of the well. Intermediate its ends, this platform 45 is provided with a longitudinally extending aperture 46 through which the propeller shaft 21 freely extends. Means preferably are provided for limiting downward movement of the propulsion unit below its full line position of Fig. 2 which may comprise cables or the like 47 secured at their lower ends to the platform 45 and at their upper ends to a cross bar supported in open-top brackets on the side walls 14 or the transom 18. It will be understood that the upper ends of these restraining cables 47 may be released by lifting the cross bar out of its brackets whenever it is desired to move the propulsion unit to its broken line position of Fig. 2 and may be employed to assist in such movement.

Adjacent the rear end of the platform 45, and depending therefrom, is secured a strut means or bracket, indicated generally by reference numeral 48, which comprises an upper pad 49 secured to the under surface of the platform 45, a laterally thin portion 51 depending from the pad 49 at substantially right angles to the same and the platform 45 and including an angularly disposed bearing portion 52 for the rear end of the propeller shaft 21. Below this bearing portion 52 the laterally thin portion 51 is bent rearwardly through approximately 90 degrees and extends rearwardly beneath the propeller substantially parallel to the platform 45. The rear end of this thin portion 51 is provided with a planar portion 53 extending laterally in each direction therefrom to present a planing surface rearwardly of and below the propeller 22 which surface is disposed at a substantially 15 degree angle relative to the axis of the propeller shaft 21. This planar portion 53 terminates at its rear end in an upwardly inclined portion 54 extending across its full width (Fig. 5), the primary function of which is to facilitate rearward movement in shallow water by preventing the strut from digging into the mud or sand. It is preferred that the several parts 49, 51, 52, 53 and 54 of the strut means 48 be formed as an integral unit.

The rearwardly extending part of the laterally thin portion 51 of the strut means 48 also functions to pivotally support a suitable rudder 55 at its lower end. The upper portion of the rudder 55 is pivotally supported by the platform 45 and is rotatably controlled in well known manner by a crank arm 56 (Fig. 1) suitably connected by an encased rod and cable, or the like, 57 to a crank arm 58 rotatable by a steering wheel 59.

From the preceding description, it will be better understood why the thrust from rotation of the propeller 22 in a direction to move the boat forwardly will be so applied, when the propulsion unit 19 is in its normal lowermost operating position as shown in full lines in Fig. 2, to maintain the unit in such lowermost operative position, and to move the unit thereto from its intermediate position of Fig. 3. This is because the propeller thrust is applied through shaft 21 and bearing bracket 28 to the bulkhead 15 through the pivots 36, and the latter are spaced upwardly from the axis of shaft 21. The forward propeller driving force thus creates a moment tending to move the rear end of the propulsion unit 19 downwardly.

With this mounting of the unit 19, however, as the boat is moving forwardly in normal operation with the unit in its full line lowermost position of Fig. 2, if some obstruction is encountered by the strut means or bracket 48, the propulsion unit will be swung upwardly about its pivot members 36 into or partly into the well of the boat as shown in Fig. 3. In that figure, reference numeral 61 indicates an obstruction in broken lines over which the bracket 48 is passing. In this intermediate position of the propulsion unit 19, continued forward motion of the boat in response to operation of the propeller 22 would be practically impossible if the rear end of the well were enclosed by the transom 18. The hood means 17 is so angularly displaced, however, as to deflect downwardly a rearwardly directed stream from the propeller 22 so as to enable effective operation of the propeller. At the same time, this hood 17 is employed primarily to close the rear end of the well sufficiently to prevent wave motion entering the same while the boat is at rest.

The shape and positioning of the planar portion 53 and its upturned end part 54 relative to the propeller 22 are very important. If this planar surface is materially increased in size from that herein illustrated, the turning moment tending to hold the unit 19 in its lowermost position during rotation of the propeller to drive the boat forwardly will be increased, but the resistance to forward

motion of the boat also will be increased and the resulting tendency to move the rear end of the boat downwardly into the water will be overly increased. On the other hand, material reduction in the area of these surfaces will render the same ineffective to automatically return the propulsion unit **19** from its intermediate position of Fig. 3 to its normal full line position of Fig. 2 after passing an obstruction, without slowing the forward speed of the boat. This automatic return feature, that is, movement of the propulsion unit downwardly to its normal operative position upon passing an obstruction, without requiring reduction of speed or stopping of the propeller, is an outstanding advantage.

The functioning of the universal joints **38** and **42** and their sliding interconnection by means of the splined shaft **39** permits continued and effective operation of the propeller **22** while it is in the intermediate position of Fig. 3. They also enable lifting of the propulsion unit **19** upwardly, such as to the broken line position of Fig. 2, to present the propeller and rudder for ready cleaning or repair from within the boat. This interconnection between the engine shaft **13** and the propeller shaft **21** also facilitates the desired pivotal mounting of the double thrust bearing **28**. The latter is essential to practical operation of the propulsion unit **19** and makes the pivotal attachment of the unit to the bulkhead **15** a relatively simple matter. It will be appreciated that either the upward displacement of the pivots **36** relative to the axis of shaft **21**, or the planar surface **53**, **54** could be so designed as alone to accomplish the desired function of maintaining the propulsion unit in its lowermost position of Fig. 2 during forward operation of the boat. It has been found, however, that the combination of these two features in the manner herein illustrated best serves to accomplish the desired results.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction, and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described and shown in the drawings being merely a preferred embodiment thereof.

I claim:

1. In a boat having an inboard engine and a well disposed rearwardly thereof, a propulsion unit operatively connected to said engine and pivotally mounted adjacent its forward end to enable upward swinging of its rear end into said well from a lowermost normal operating position, comprising a propeller shaft, a propeller mounted on the rear end of said shaft, strut means providing bearing means for the rear end of said shaft, and means for urging the rear end of said unit downwardly into said normal operating position, in response to rotation of said propeller tending to impart forward motion to the boat, including a portion of said strut means rigidly secured thereto and extending below and rearwardly of said propeller and upwardly and rearwardly at an angle to said shaft, said portion of said strut means comprising a main planar part forming an angle of approximately 15 degrees with the axis of said shaft disposed rearwardly of said propeller and terminating in a rear end extending angularly upwardly therefrom.

2. In a boat having an inboard engine and a well disposed rearwardly thereof and including a bulkhead forming the forward wall of said well, a propulsion unit, comprising a propeller shaft, a propeller mounted on the rear end of said shaft, a rudder mounted rearwardly of said propeller, a strut disposed below said shaft and having an integral horizontal planar portion below and rearwardly of said propeller, a double thrust bearing rotatably supporting the forward portion of said shaft and including a housing, a bracket comprising a laterally extending base secured intermediate its ends to said housing and upwardly and forwardly extending legs secured at their lower ends to the ends of said base, and means for pivotally securing the upper ends of said legs on a laterally extending axis to said bulkhead above the axis of said shaft.

3. In a boat according to claim 2, a platform secured at its forward end to said bracket base at points spaced laterally from said shaft on each side thereof, and mounting means for said rudder and the rear end of said shaft secured to and depending from the rear end of said platform.

4. In a boat having an inboard engine and a well disposed rearwardly thereof and including a bulkhead forming the forward wall of said well, a propulsion unit, comprising a propeller shaft, a propeller mounted on the rear end of said shaft, a rudder mounted rearwardly of said propeller, a double thrust bearing rotatably supporting the forward portion of said shaft, bracket means secured to said bearing and pivotally mounted on said bulkhead above the axis of said shaft so that forward propeller thrust will be transmitted to said bulkhead and will create a moment urging the rear end of said shaft downwardly, and a platform secured at its forward end to said bracket means and having depending strut means secured at its rear end for rotatably supporting the rear end of said shaft and the lower end of said rudder and including an integral horizontal planar portion disposed rearwardly and below said propeller, said platform normally being maintained during the generation of forward thrust by said propeller in a lowermost position substantially closing the bottom of said well.

5. A boat according to claim 4, wherein the striking of an obstruction by said depending strut means will raise the rear end of said propulsion unit, including said propeller and rudder, to an intermediate position in the rear end of said well, and a downwardly and rearwardly extending hood substantially closing the rear end of said well and adapted to deflect a rearwardly directed propeller stream downwardly.

6. In a boat having an inboard engine and a well disposed rearwardly thereof at the rear end of the boat and defined by side and forward walls, a propulsion unit having a propeller shaft operatively connected at its forward end to said engine and a propeller mounted on the rear end of said shaft, means for pivotally mounting said unit at the forward end thereof whereby said propeller may be raised from a normal operating position into the rear portion of said well between said side walls, and a downwardly sloping hood extending rearwardly beyond the rear end of the boat and defining the rear end of said well for keeping wave motion out of the well when the boat is stopped and for deflecting downwardly the rearwardly directed stream from said propeller when the latter is operating while in said well between the side walls thereof.

7. In a boat having an inboard engine and a well disposed rearwardly thereof at the rear end of the boat and defined by side and forward walls, a propulsion unit having a propeller shaft operatively connected at its forward end to said engine and a propeller mounted on the rear end of said shaft, means for pivotally mounting said unit at the forward end thereof to one or more of said walls for movement of the rear end of the unit between a lower normal operative position, an intermediate operative position with said propeller disposed in said well between said side walls, and an upper position with said propeller above said well, strut means extending below said propeller for protecting the same against damage by obstructions and operable to raise said unit to said intermediate position during forward movement of the boat when an obstruction is encountered, and a downwardly sloping hood extending rearwardly beyond the rear end of the boat and substantially closing the rear end of said well to deflect downwardly a rearwardly directed stream from the propeller when said unit is in said intermediate position.

8. In a boat having an inboard engine, a well disposed

rearwardly thereof, and a propulsion unit comprising a platform normally disposed at the bottom of said well, a propeller shaft extending freely downwardly through and at an angle to said platform, a propeller on the rear end of said shaft, thrust bearing means rotatably supporting the forward end of said shaft and having the forward end of said platform secured thereto, and means for pivotally securing said thrust bearing means to the boat to enable the rear end of said platform and said propeller to be swung upwardly into said well; strut means for rotatably supporting the rear end of said shaft and protecting said propeller against damage from obstructions encountered, comprising an upper pad secured to the rearward portion of said platform, a laterally thin portion depending from said pad substantially perpendicular to said platform and including a bearing for the rearward end of said shaft, said laterally thin portion below said bearing extending rearwardly beneath said propeller substantially parallel to said platform, and a planar portion rigidly secured to, and extending rearwardly and laterally from, said thin portion to present a planing surface rearwardly of and below said propeller which is angularly disposed relative to the axis of said shaft, and said planar portion terminating in an upwardly inclined end portion for the full width thereof, whereby a stream from said propeller, during rotation thereof to impart forward motion to the boat, will be impinged against said planing surface to produce a downwardly directed force component tending to maintain said platform in normal position at the bottom of said well.

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