United States Patent [19]

Woodfill

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[54] **MARINE DRIVE TRANSOM SEAL APPARATUS**

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[73] Assignee: **Brunswick Corporation,** Skokie, Ill.

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[21] Appl. No.: **317,354**

[52] **U.S. Cl.** ..... **115/11,** 115/34 R

[51] **Int. Cl.** **B63h 11/00**

[58] **Field of Search** ..... 115/11, 12, 14, 15, 16, 115/34, 35, 41, 0.5 R; 114/151; 60/221

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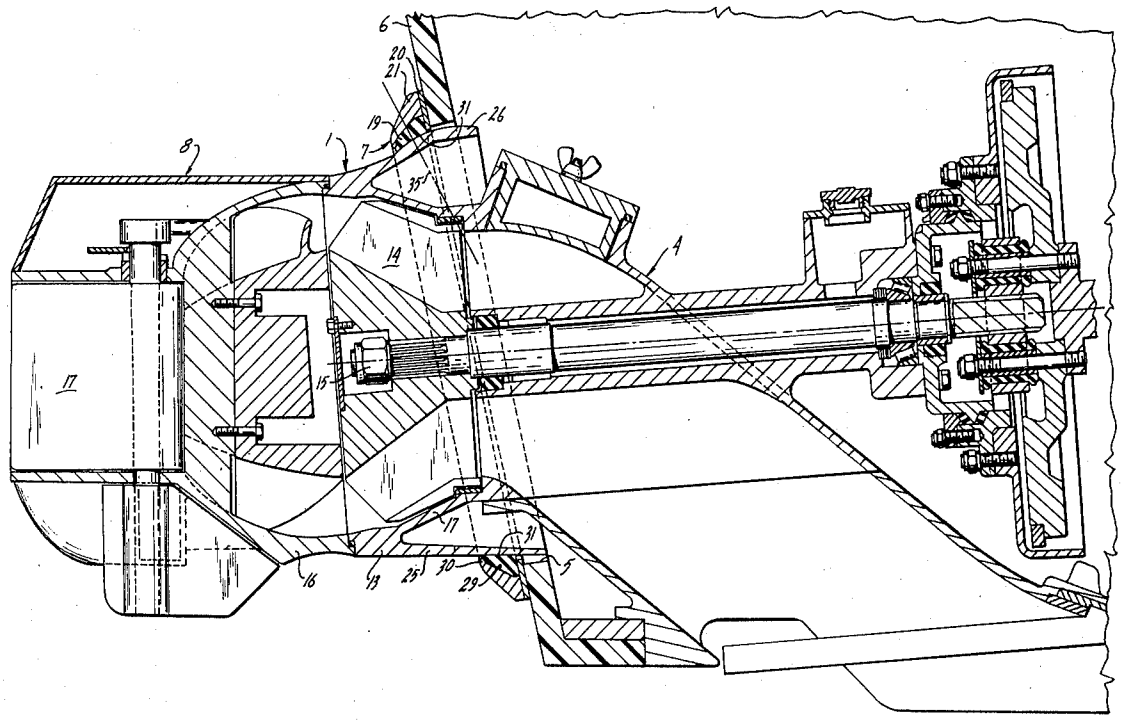
Attorney, Agent, or Firm—Andrus, Sceales, Starke & Sawall

[57] **ABSTRACT**

A jet propulsion unit for a boat includes a generally rectangular pump housing section extended through a transom opening. A seal unit includes an O-ring seal compressed between a pair of brackets secured to the transom about the opening. The bottom wall and the side walls of the unit and the opening are formed as a flat planar member. The upper wall of the housing is formed with an upwardly curved surface from an aft portion of the propulsion unit toward the inner portion of the propulsion unit to create successively changing cross-sectional area taken on a vertical plane through the unit and thereby maintain an essentially constant sealing requirement with the unit in the opening. The bottom surface thus defines a reference with the upper surface configured to accommodate transom angles between zero to 20° while maintaining effective engagement of the single encircling seal member with the sealing surface of the housing. The seal unit thus encounters an essentially constant spacing between the housing and the seal bracket for all transom angles and a single unit may be used on all transoms. The rectangular construction of the housing locates the side walls spaced outwardly of a pump bowl wall and defines a discharge channel within which an exhaust pipe is located. This avoids the necessity of transom openings normally provided for the exhaust pipes as well as the requirement of a number of different fittings to accomplish the connection of the exhaust pipes through the transom. The exhaust is discharged into the water to also reduce the exhaust noise.

14 Claims, 8 Drawing Figures



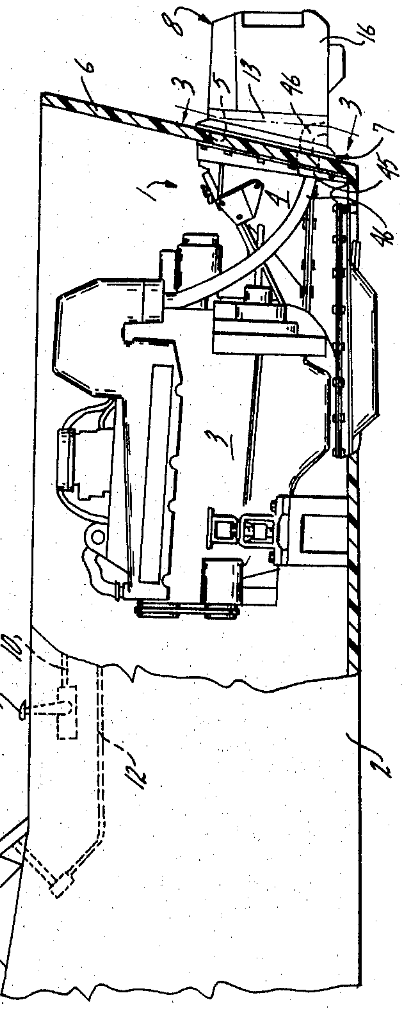


FIG_1

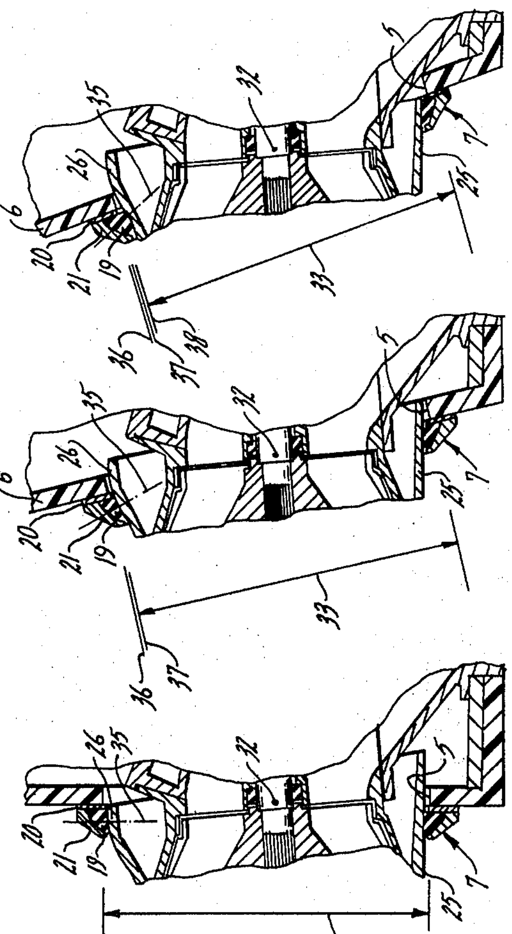


FIG_5 FIG_6 FIG_7

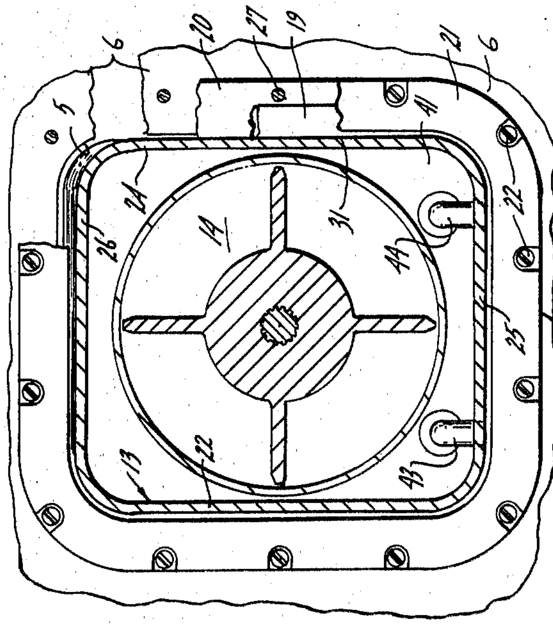


FIG_3

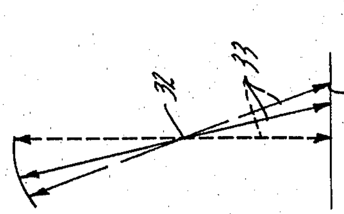


FIG_8

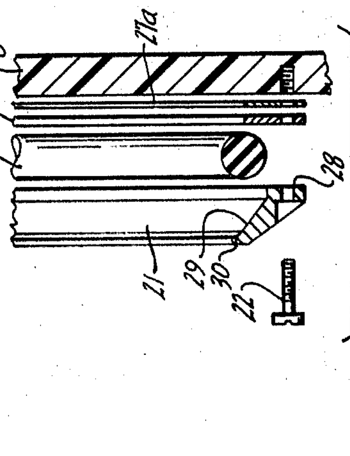


FIG_4

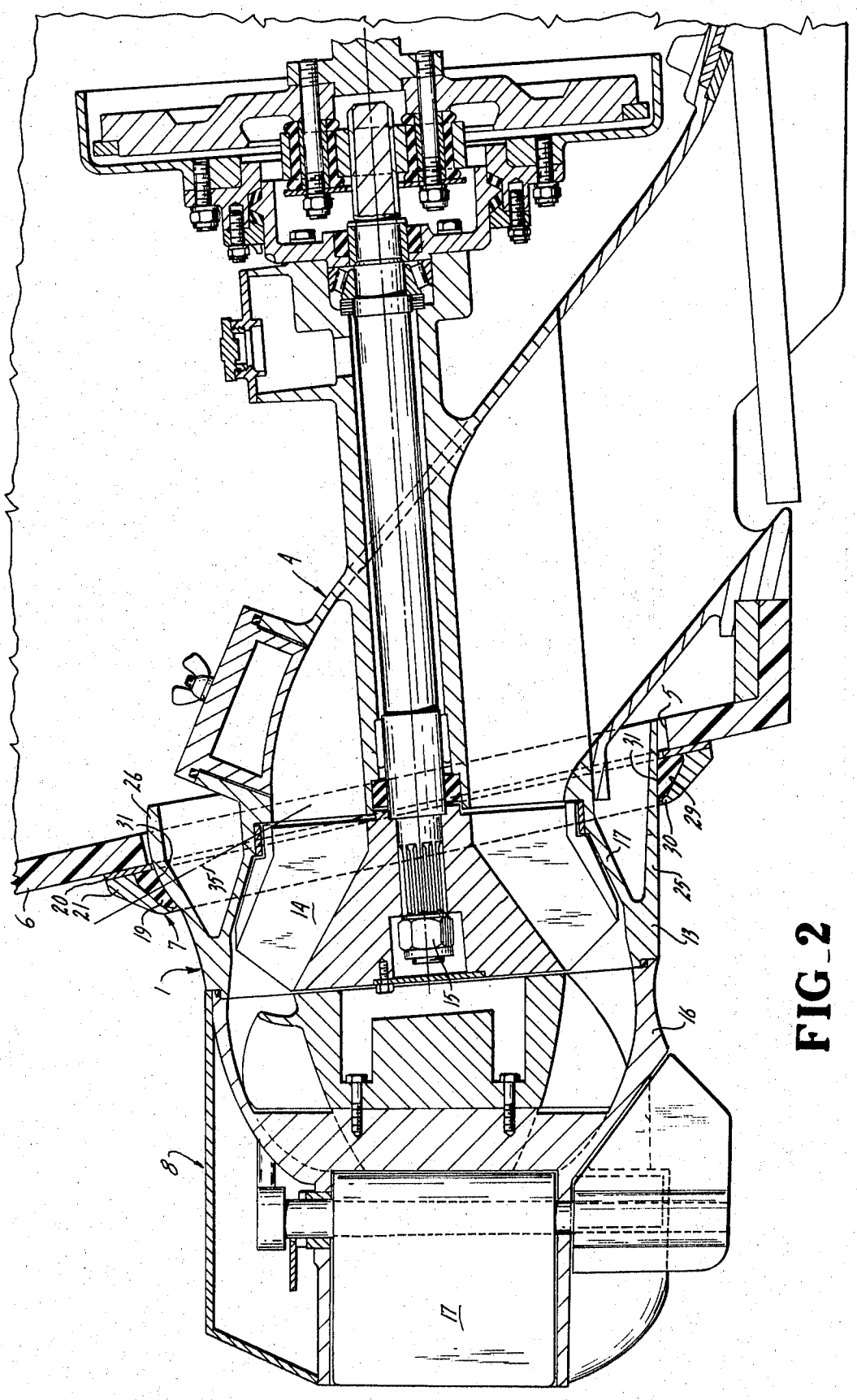


FIG_2

MARINE DRIVE TRANSOM SEAL APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a marine drive transom sealing means and particularly to a sealing apparatus which is readily adapted to the multiple angled transoms employed in various watercraft.

The conventional small pleasure boat includes a rear transom to which any one of various propulsion means may be secured. A highly satisfactory drive includes an inboard-outboard drive and in particular the more recently developed jet propulsion drive means of an inbroad-outboard construction. For example, a highly improved jet drive unit is disclosed in applicant's copending application entitled "Marine Jet Drive Propulsion Apparatus" which was filed on the same day as this application and was assigned to a common assignee therewith. As disclosed in such application, the drive engine is mounted inboard of the transom with a pump unit coupled to the engine and extended outwardly through an opening in the transom to locate the discharge or jet nozzles aft of the transom.

In such inboard-outboard drives, the transom opening is sealed about the projecting drive unit. The sealing means preferably includes a resilient construction to isolate vibration and thrust forces generated within the propulsion means from the transom. Sealants and other related compounds are also employed to provide a positive transom seal.

Although satisfactory boat transom opening seals have been constructed, they have required constructions related to a particular boat or class of boat. The propulsion unit is mounted in a fixed angular relationship to the bottom of the boat. The angle of the transom with respect to a true vertical plane varies significantly, however; generally, the angle lies between zero and twenty degrees with respect to a vertical plane. The prior art has generally provided a plurality of transom brackets or plates each of which is particularly designed to fit a particular transom angle or limited range of transom angles, in order to compensate for the difference in the spacing between the edge of the transom opening and the sealing bracket. Although such systems have been generally satisfactory, a single universal transom mount for sealing to essentially any particular transom would be highly desirable.

SUMMARY OF THE PRESENT INVENTION

The present invention is particularly directed to a universal transom mounting system which will assure a positive transom seal mounting of a drive for essentially all boat transoms including any one of the conventional transom angles, generally from zero to twenty degrees and the like. Generally, in accordance with the present invention, the transom opening is somewhat larger than the propulsion housing means extending therethrough. An oversized enlarged diameter resilient sealing means encircles the housing means and extends outwardly in overlapping relationship to the edge of the opening. The sealing means is clamped and compressed to the transom for optimum mounting between a pair of clamping and mounting means having an opening also somewhat larger than the propulsion housing means and a flange means overlying the transom to permit rigid bolting or other interconnection to the transom. In accordance with the present invention, a wall portion of the propulsion housing is formed with a curved configuration which has an increasing rate of curvature between an aft housing portion and the forward housing portion aligned with the sealing means as the transom angle increases.

The effective vertical opening which must be sealed by the sealing means varies with the angle, and the housing portion is similarly inversely varied to maintain an essentially constant spacing between the resilient sealing means and the housing. In a preferred construction, the top wall is curved with respect to a flat and fixed bottom wall as well as flat side walls to define a generally rectangular configuration. The top wall is curved with the radius of curvature generally defined or generated by pivotally rotating of the seal means about a selected point located centrally on the flat side walls of the housing while maintaining the lower edge in essentially the same reference with respect to the flat and fixed bottom wall. Thus, in generating the curved configuration, the pivot point remains constant, but the unit moves upwardly in order to maintain a straight-line movement of the lower-most edge or portion. This has been found to permit the ready application of an encircling ring seal concept to all anticipated openings. In a practical construction, the surface can be formed with a radius approximating the curves generated as described above to facilitate production casting. The seal unit is preferably constructed with a flat mounting member adapted to abut the transom. An outer clamp member is bolted to the first member and includes an inclined wall terminating in an outer lip defining a generally triangular recess. A rectangular seal ring having a round cross-section larger than the recess is compressed therein and thereby forced outwardly into sealing engagement with the adjacent surface of the drive housing.

The seal means of the present invention must only establish a seal for an essentially constant spacing between the drive housing and the seal bracket. The creates a relatively constant location on the transom. This is in contrast to the prior art concept of employing varying dimensional brackets which compensate for the transom angle.

The rectangular construction is also advantageous in that the pump unit generally includes curved or round impeller bowl means such that the side wall of the housing is spaced outwardly of the pump bowl wall, particularly in the corner portions of the outer housing. This provides a natural discharge channel within which an exhaust system can be incorporated and coupled through the impeller housing assembly to the engine exhaust. This construction not only avoids the additional transom openings normally provided for the exhaust pipes, but results in a compact and neat-appearing unit as well as providing more supression at discharge of the exhaust gases of an internal combustion engine and the like. The present invention thus provides a novel and improved system for mounting of propulsion means in the transom of the boat.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings furnished herewith illustrate the best mode presently contemplated for carrying out the invention and clearly disclose the above advantages and features as well as others which will be readily understood from the following description of such illustrated embodiment.

In the drawings:

FIG. 1 is a fragmentary side elevational view of a watercraft employing a jet propulsion unit mounted to a transom in accordance with the present invention;

FIG. 2 is an enlarged vertical longitudinal section through the watercraft shown in FIG. 1 and clearly illustrating the transom seal unit constructed in accordance with the present invention;

FIG. 3 is a vertical section taken generally on line 3—3 of FIG. 1;

FIG. 4 is an enlarged fragmentary exploded view of the transom sealing unit;

FIGS. 5–7 are similar fragmentary sectional views showing various typical angular transom mounts with the same seal unit to clearly illustrate the operation of the present invention; and

FIG. 8 is a diagrammatic illustration showing a method of determining the generation of a surface for a preferred construction.

DESCRIPTION OF ILLUSTRATED EMBODIMENTS

Referring to the drawings and particularly to FIG. 1, a marine propulsion unit 1 is mounted within a boat 2, of which only a fragmentary portion is shown. The propulsion unit 1 includes a suitable power source such as an internal combustion engine 3 connected to a drive pump unit 4 which extends through an opening 5 in the boat transom 6. A sealing unit 7 constructed in accordance with the present invention is attached to transom 6 to seal the opening 5 about the pump unit 4. The pump unit 4 has an inlet opening in the lower wall portion of the boat 2 and is adapted to draw water upwardly through the boat, pressurizes the water and delivers the pressurized water through a discharge or jet control unit 8 mounted aft of the transom and interconnected to and forming a part of the pump unit 4. A remote steering control includes a shift lever 9 connected to a shifting cable 10 for selecting forward and reverse movement, and a steering wheel 11 connected by a steering cable 12 for turning laterally to the right or left side, as more fully developed hereinafter. The precise construction of the pump unit 4 may be of any suitable design which will transfer the necessary large volume of water, greatly increases its momentum and discharges such water through the rear control unit 8 which extends from the aft end of the boat outwardly generally on the longitudinal center of the boat.

The illustrated pump unit 4 is constructed in accordance with the teaching of applicant's previously referred to application. Generally, the pump is a mixed-flow centrifugal construction having an inner or forward housing 13 mounted forwardly of the transom and projecting rearwardly through the transom opening 5. The pump impeller 14 is rotatably mounted within the forward housing section and secured to the shaft by a suitable clamping bolt 15 or the like. A rearward impeller housing 16 is integrally formed with control unit 8 and includes a rear cylindrical impeller bowl for directing the increased-momentum water rearwardly in the outermost end of the control unit 8 as a pair of jet streams to the opposite sides of pivotally mounted steering rudder 17, as more fully disclosed in applicant's copending application previously referred to. The pump unit 4 is mounted within the boat 2 with the axis of the impeller shaft 18 accurately located with respect to the horizontal and particularly the bottom of the boat and at the same angle regardless of the angle of the transom 6. Suitable means connected to cables 10 and 12 are provided to control the jet direction for steering and the like.

As the details of the units 4 and 8 are not necessary to a full understanding of the present invention, no further detailed description thereof is given.

The present invention is particularly directed to the transom sealing system or unit 7 which is secured to the aft surface of the transom 6 and extends inwardly into resilient mounting sealing engagement with the outer adjacent wall portion of the propulsion housing means 13. Generally, the sealing means 7 includes a large ring seal 19 of an elastomeric material or any other suitable resilient medium. The seal 19 is disposed in encircling engagement with the housing 13 of the propulsion unit 1 and is clamped between a pair of mounting members or brackets 20 and 21 which are bolted as by bolts 22 to the aft surface of the transom 6. The brackets 20 and 21 compress the ring seal 19 and establish an outward seal movement to firmly engage the exterior of housing 13 and create a liquid-tight joint.

More particularly, in accordance with the preferred construction of the present invention, the impeller housing, and particularly portion 13 as shown in FIG. 3, has an essentially rectilinear configuration with relatively straight side walls 23 and 24 and a flat or horizontal bottom wall 25. The propulsion means 1 is located with the side walls 23 and 24 in a vertical plane and the bottom wall 25 in a horizontal plane. The upper wall 26 of the housing 13 is provided with a special curvature extending from the rear portion of the housing 13 outwardly of the transom 6 to a front portion within the transom 6 for all anticipated angles of the transom 6. The wall 26 curves upwardly continuously from a rear portion constituting the maximum degree transom angles.

The members 20 and 21 of the seal unit 7 define a first clamping bracket 20 generally of rectangular configuration having an apertured flange as at 27 through which attachment bolts 22 pass to locate the bracket abutting the aft surface of the transom 6. The bracket 20 abuts the transom and is located in outwardly spaced relation to the transom opening 5 and the propulsion housing 13. A sealing gasket 27*a* may be located between the bracket 20 and the transom to provide a seal. The second clamping member 21 includes an aperture flange 28 which abuts the first member and is secured by bolts 22 to the transom. The bracket 21 extends rearwardly of the transom and inwardly toward the housing 13 to define a recess or chamber 29 within which the seal 19 is compressed. In the illustrated embodiment of the invention, the recess 29 includes a short flat wall which projects rearwardly from the abutting first bracket 20 and then angularly rearwardly and inwardly to a final inwardly-projecting lip portion 30 which terminates in close spaced relation to the housing 13.

The sealing member 19 may be simply formed as an O-ring of a generally rectangular configuration in the unstressed state which, upon tightening of clamping members 20 and 21 to the transom 6, is deformed to the configuration of the recess 29 and also forced outwardly into firm sealing engagement with the adjacent exterior surface of the housing 13 of the jet propulsion unit 1 as at 31.

In the illustrated embodiment of the invention of FIGS. **1, 2** and **6,** the transom angle is thirteen degrees. The longitudinal center line or axis **18** through the propulsion means **1** is mounted with a predetermined angular orientation with respect to the horizontal regardless of the transom angle. As most clearly shown in FIGS. **2** and **5–7,** the flat bottom wall **25** of the housing **13** also defines a reference which is located as a fixed reference regardless of the transom angle. This reference plane may be employed to develop the curved upper wall **26** and in particular the rate of curvature such that a line extended from a point on the bottom wall or lower edge of the transom opening **5** or the like through a central common point to the top wall and rotated through the anticipated transom angles moves along a curve generally corresponding to that developed by the upper edge of the transom opening for corresponding rotation of the transom **6.**

Thus, referring particularly to FIG. **8,** the method of generating wall **26** is diagrammatically shown by the movement of a line **33** representative of the length of the transom opening between a 0° transom angle position and a 20° transom angle. The bottom end **34** of line **33** follows the horizontal or bottom wall reference. To maintain the line **33** passing through the common pivot point **32,** the line moves upwardly such that the upper end develops a curved surface providing an optimum or preferred shape to the upper wall **26.**

In the illustrated embodiment of the invention, the top wall **26** is shown defined by a generally constant curvature which has a common radius such as shown at **35.** The curve quite closely approximates the curve generated as shown in FIG. **8** and has been found to provide a practical and reliable seal. In the construction, the common center **32** is located and a square transom opening **5** cut in the transom **6.** A suitably shaped gauge, not shown, may be provided for locating of center **32** and the associated water pick-up opening in the bottom wall of the boat and a template, not shown, for cutting of opening **5.** Thus, one leg of the L-shaped gauge would have a projection to locate the pivot point, which when abutting the transom would properly locate the fore and aft edges of the inlet opening. In FIG. **5,** upper end of transom opening **5** is diagrammatically shown by the reference line **36** for a zero-angle transom.

A thirteen-degree transom is shown in FIGS. **2** and **6,** with the opening shown diagrammatically by line **36,** as measured from the bottom surface **25** shortened as to line **37.** The curved surface or wall **26** accommodates this reduction and maintains the same effective sealing gap.

A 20° transom is shown in FIG. **7.** The transom opening is shown at **38,** with the curved wall **26** again compensating for the opening in the further variation of the transom from that of FIGS. **5** and **6.**

This construction thus forms a minimum vertical cross-section in alignment with the largest angled transom mount positions to maximum projected vertical cross-section in alignment with the smallest or minimum-angled transom mount positions. The difference in the position of lines **36–38** illustrates the variation which is compensated for by the special housing, and which permits the use of the single universal seal unit.

The generally rectangular housing **13** with the one curved wall and three planar walls provides a convenient sealing configuration. The illustrated large O-ring seal with the circular cross-section is a convenient and practical unit, but special cross-sections may, of course, be used. Further, such cross-sectional housing **13** defines a channel or free space **41** between the outer side walls **23** and **24** and the impeller bowl **42** which is integrally cast or otherwise mounted within the housing **13.** In accordance with a further aspect of this invention, engine exhaust tubes **43** and **44,** or other passageway means, are located within such channels **41.** Each tube **43** and **44** is similarly constructed, and tube **43** is described. The tube **43** includes a flanged coupling end **45** extending through the transom opening face of the housing **13** for connection to the corresponding engine exhaust pipe **46.** The tube **43** is generally L-shaped and extends downwardly through the bottom wall **25** of the housing **13** to exhaust the gases below the water level forwardly of the control unit **8.** This not only produces an improved appearance but noticeably reduces noise, particularly at idle and low speed. In addition, the construction eliminates the conventional exhaust tube openings in the transom with the attendant expense and adverse appearance.

The generally rectangular housing defines a constant side and bottom dimension which, with the upper wall shaped across its width to take up the increased dimension, permits relatively simple, convenient casting. The same concept and teaching can be applied to other configurations, but in order to obtain an effective seal, may require a somewhat more complicated expansion of the housing structure to maintain an essentially constant transom opening gap which can be essentially effectively sealed with a single seal member.

The present invention thus provides a simple and inexpensive construction for a jet propulsion drive means which eliminates the duplication and multiplication of parts for adaption of jet propulsion drive means to the widely varying boat constructions presently available and employed.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims, particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A sealing and mounting apparatus for a transom mounted jet propulsion unit wherein the propulsion unit may be mounted within any one of a plurality of boats having selected different angled transoms comprising in combination, a jet pump housing means having an internal boat mounting means for mounting of the housing within a boat with the housing means projecting outwardly through a transom opening and terminating rearwardly of the transom, said housing means having pump mounting means and further including an outer wall means encircling said pump mounting means, said outer wall means including a top wall and a bottom wall joined by opposite side walls, a first of said top and bottom walls being a flat wall and the second of said top and bottom walls being a vertically varying dimensional wall defining a transverse sealing cross-sectional configuration which is substantially constant in cross-section relative to said opening when in alignment with the largest-angle transom mount position and when in alignment with the minimum-angle transom mount position and with the vertical axial cross-section of the housing varying in a non-circular configuration and with a single diminishing cross-section from the location of the zero axis transom

mounting, a resilient encircling sealing means disposed between the housing and the opening in said transom, and compressing means adapted to be attached to the transom and compressingly engaging said resilient encircling sealing means and compressing the same against the outer wall means, said varying dimensional housing wall permitting the adaptation of the single mounting means to the different angled transom.

2. The sealing and mounting means of claim **1** wherein said compressing means includes a pair of ring members adapted to be attached to the exterior wall of the transom with said resilient encircling means disposed therebetween.

3. The sealing and mounting apparatus of claim **1** wherein said sealing means is generally an endless member corresponding generally to the configuration of the housing.

4. The sealing and mounting apparatus of claim **1** wherein said side walls are planar walls to form a generally rectangular outer housing.

5. The sealing and mounting apparatus of claim **4** wherein said sealing means is generally a rectangular endless member corresponding generally to the rectangular configuration of the housing.

6. The sealing and mounting apparatus of claim **5** wherein said endless member has an unstressed cylindrical cross-section.

7. The sealing and mounting apparatus of claim **4** wherein said housing projecting rearwardly of the transom includes an inner impeller housing of a general cylindrical configuration and defining a channel between the impeller housing and the outer side wall and the bottom wall, and an exhaust passageway means formed in said channel and extending inwardly of the housing section through the transom opening and terminating in communication with an opening in the bottom wall of the outer housing, the inner end of said passageway means having an input adapted for connection to an engine exhaust system.

8. The sealing and mounting apparatus of claim **1** wherein said outer wall means is generally rectangular within and to the opposite sides of said transom opening and including planar vertical side walls and a planar bottom wall interconnected to each other by generally small radius corners and adapted to be located in a generally rectangular transom opening, the upper wall of said housing means being integrally formed with said planar side walls, said top wall forming said varying dimensional wall and extending vertically upwardly and axially inwardly through said transom opening, said top wall being a cylindrical surface with respect to the bottom wall whereby an essentially constant top sealing gap is obtained for various transom angles.

9. The sealing and mounting apparatus of claim **8** having an inner impeller housing of a generally cylindrical configuration mounted within outer wall means and defining a channel between the impeller housing and the vertical side walls and the bottom wall, and an exhaust passageway means formed in said channel and extending inwardly of the outer wall means through the transom opening and terminating in communication with an opening in the bottom wall, the inner end of said passageway means having an input adapter for connection to an engine exhaust system.

10. In a marine propulsion apparatus mounted within a transom of a boat comprising, in combination, a boat having a transom, an opening extending longitudinally through said transom, a jet housing means extending through said opening and being spaced from said transom opening and terminating rearwardly of said transom, said housing having a generally rectangular configuration within and to the opposite sides of said transom opening and including planar vertical side walls and a planar bottom wall interconnected to each other by generally small radius corners, said transom opening being a generally rectangular opening slightly larger than the housing means, and the upper wall of said housing means being integrally formed with said planar side walls, said top wall having an arcuate portion extending vertically upwardly and axially inwardly through said transom opening.

11. The marine propulsion apparatus of claim **10** wherein said arcuate portion is a curved surface having a common center and whereby an essentially constant top sealing gap is obtained for various transom angles.

12. A marine jet propulsion apparatus having a jet pump housing means projecting rearwardly through a transom opening, comprising an outer housing projecting through said opening, an inner impeller housing of a generally cylindrical configuration mounted with said outer housing and defining a channel between the impeller housing and the outer housing, and an exhaust passageway means formed in said channel and extending inwardly of the housings through the transom opening and terminating at the opposite end in communication with an opening in the bottom wall of said outer housing for discharge of exhaust gases downwardly toward the body of water, the inner end of said passageway means having an input adapter for connection to an engine exhaust system.

13. The marine jet propulsion apparatus of claim **12** wherein said outer housing means is generally a rectangular housing having three generally planar walls interconnected to define three sides of the housing and a top arcuate wall, said impeller located centrally of said jet pump housing means and defining a pair of said channels, one to each side of said impeller housing, and an exhaust passageway means being formed in each of said channels.

14. A marine jet propulsion apparatus having an inboard drive engine, comprising a drive unit including an outer housing projecting rearwardly through a transom opening and having an inner jet forming housing for propulsion of a boat on a body of water, said jet forming housing having an inner bottom wall spaced upwardly from a bottom wall of the outer housing, an exhaust passageway means extending through the transom between the bottom wall of the jet forming housing and the bottom wall of the outer housing and extending downwardly through said bottom wall of said outer housing, and said exhaust passageway means terminating at the outer end in a downwardly directed discharge opening for discharge of exhaust gases downwardly into the body of water, the inner end of said passageway means having an input adapter for connection to the engine exhaust system.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. 3,859,951

DATED January 14, 1975

INVENTOR(S) : WILLIAM L. WOODFILL

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

Column 2,	Line 39,	before "cre-" cancel "The" and insert --- This ---;
Column 8, Claim 13	Line 38,	after "housing" cancel "means";
	Line 41,	after "impeller" insert --- housing ---.

Signed and sealed this 27th day of May 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks