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Nugteren et al.

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(54) **PERSONAL WATERCRAFT HAVING A PREFORMED RUB RAIL**

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(51) **Int. Cl.**[7] **B63B 35/73**
(52) **U.S. Cl.** **114/55.5**; 293/126
(58) **Field of Search** 114/55.5, 219; 293/1, 126, 127, 128

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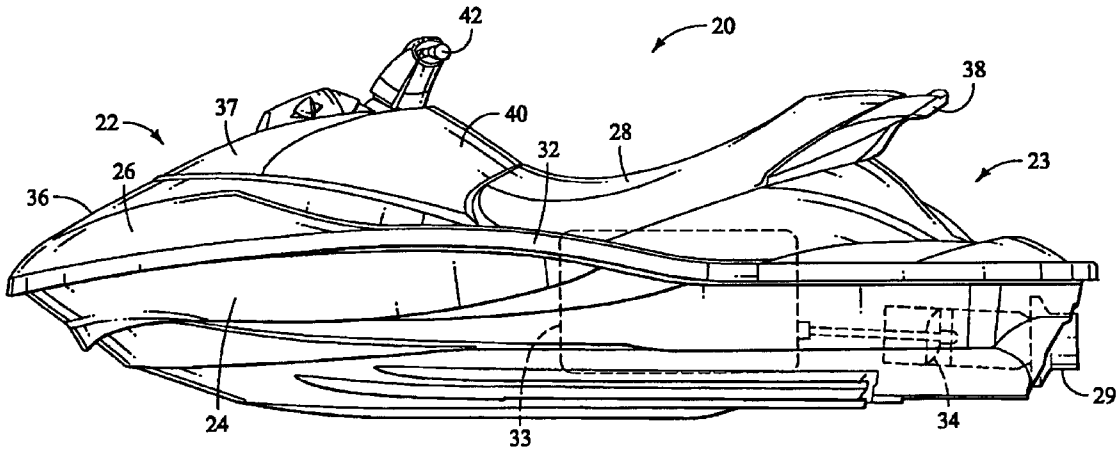
(57) **ABSTRACT**

Personal watercraft having extruded rigid rub rails that can be curved in vertical and horizontal dimensions to provide complex geometries in watercraft. One rub rail has a pair of resilient opposed converging wings extending outwardly from the rub rail to form an open channel along the rub rail length. A first bottom lip can extend inwardly to hug the downwardly facing surface of the top deck. A second lip can curve upward and inward beneath the first inwardly extending bottom lip. The second lip can provide an increased ability to hug sharp horizontally curved corners of the watercraft without wrinkling, for example, the rear corners of the watercraft. The rub rail can be both vertically and horizontally curved in the same region and be affixed to a vertical bond flange. In some personal watercraft, the rub rail is formed of a rigid material having a Shore A hardness of at least about 90. The complex geometries of some rub rails are created by heating the rub rail, securing the rub rail to a forming jig or fixture, and allowing the rub rail to cool. The cooled rub rail can thus have the preformed, complex geometry of the top deck to which it is to be affixed, while having a transverse profile than cannot be made by injection molding.

27 Claims, 8 Drawing Sheets



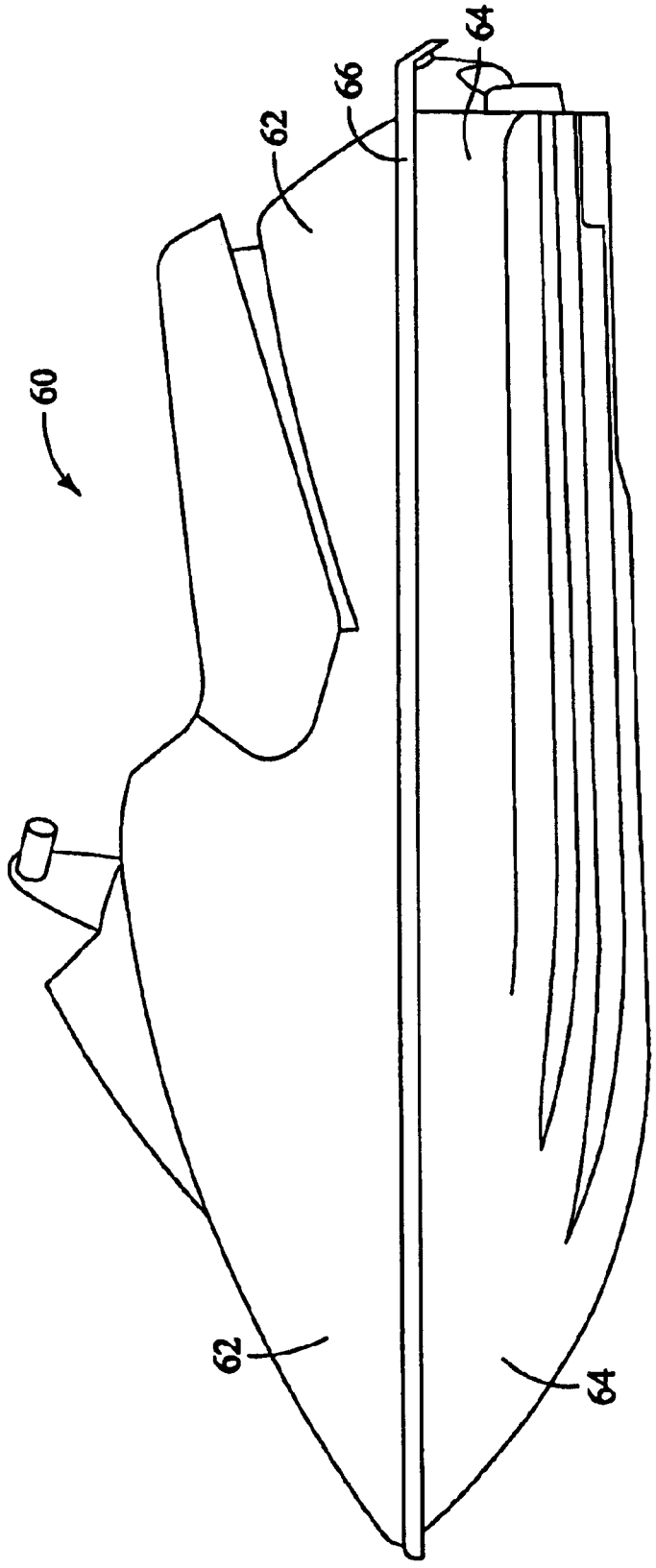


FIG. 1
PRIOR ART

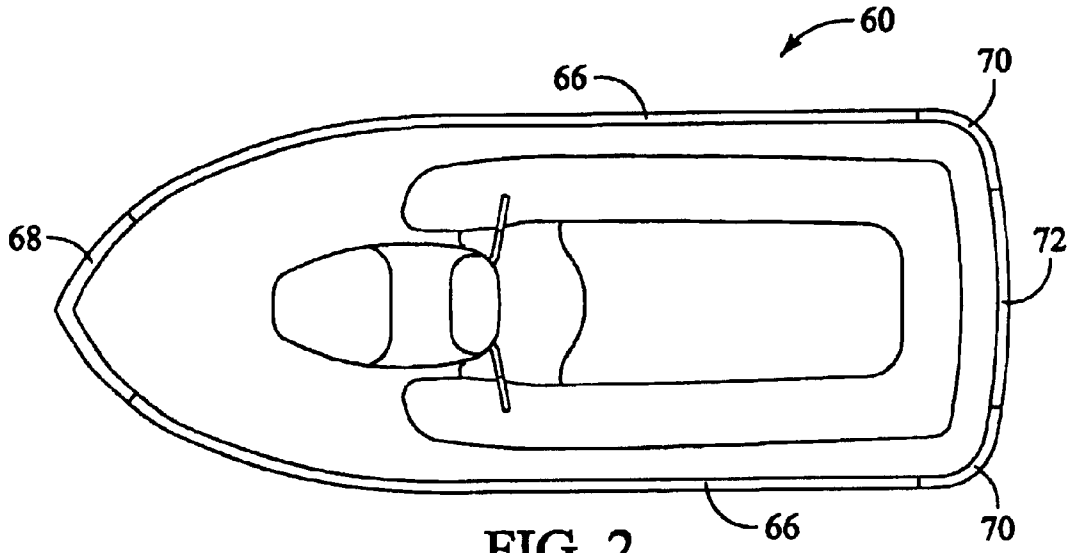


FIG. 2
PRIOR ART

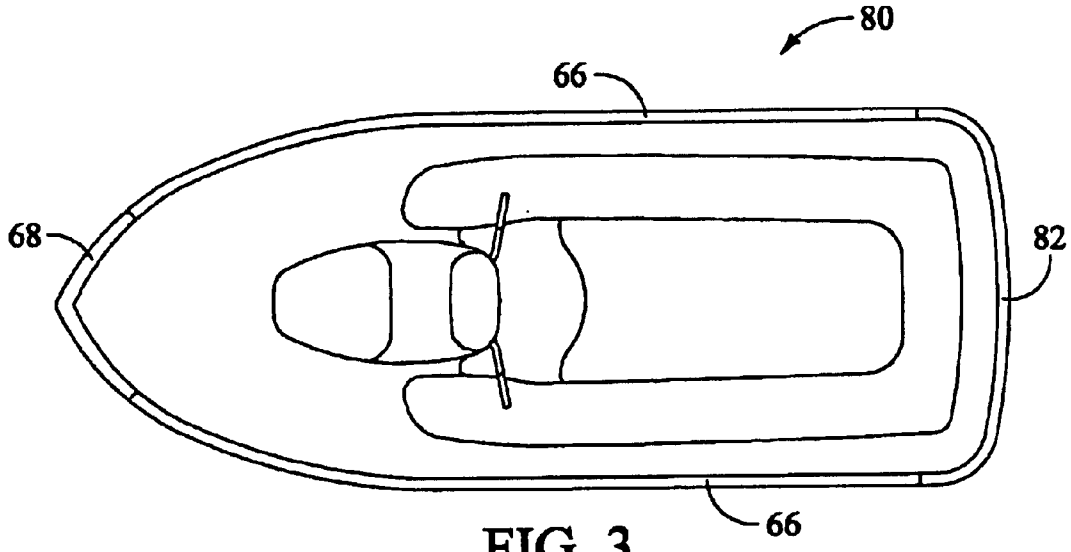


FIG. 3
PRIOR ART

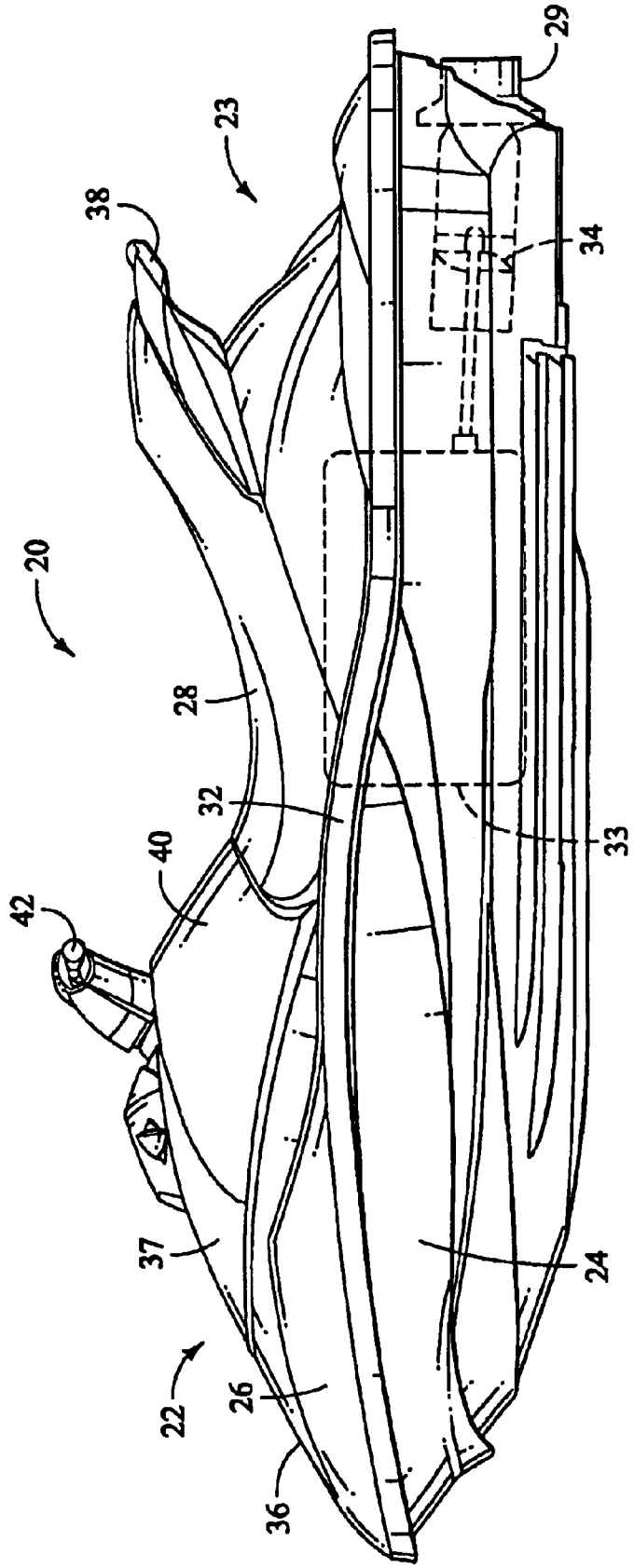


FIG. 4

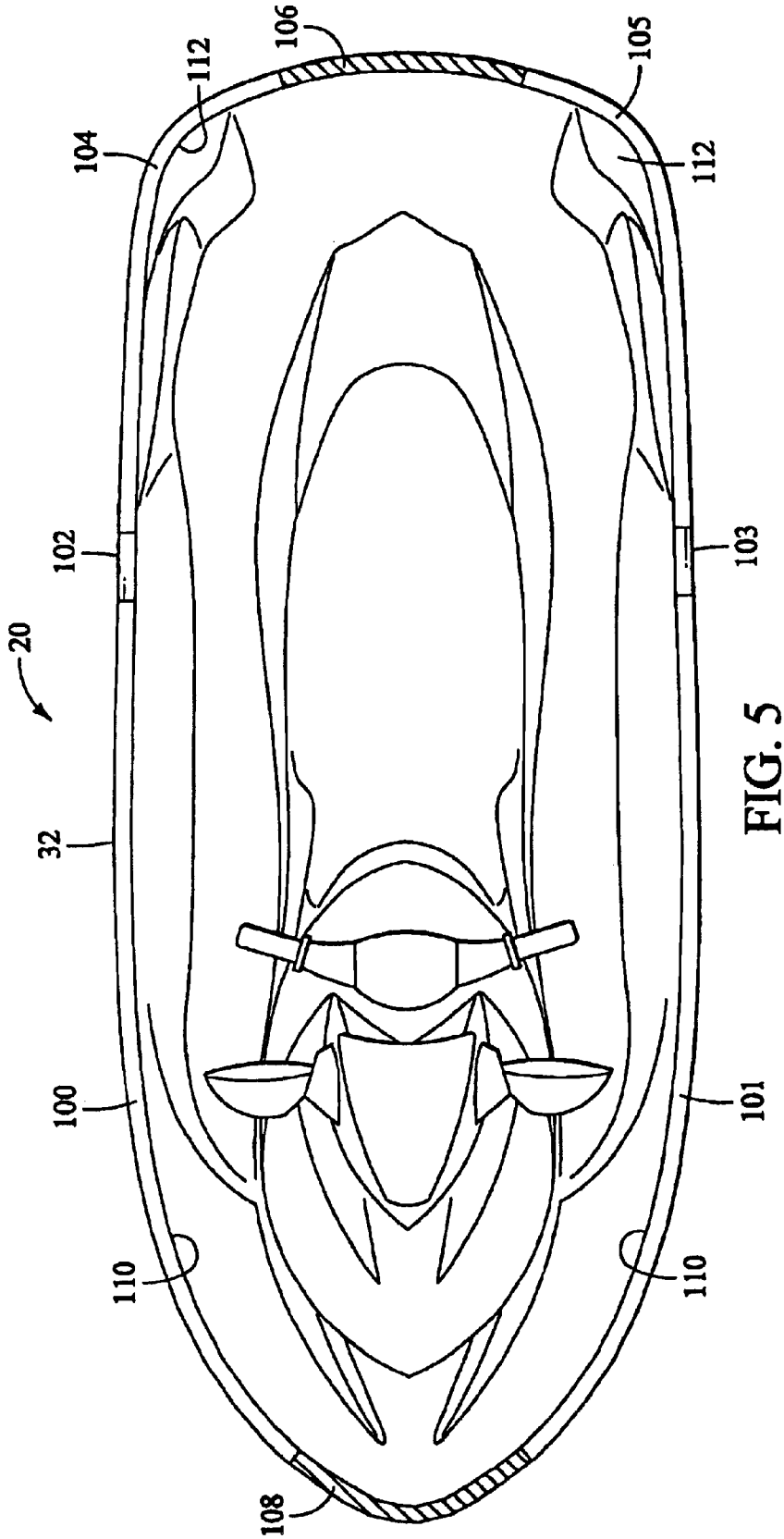


FIG. 5

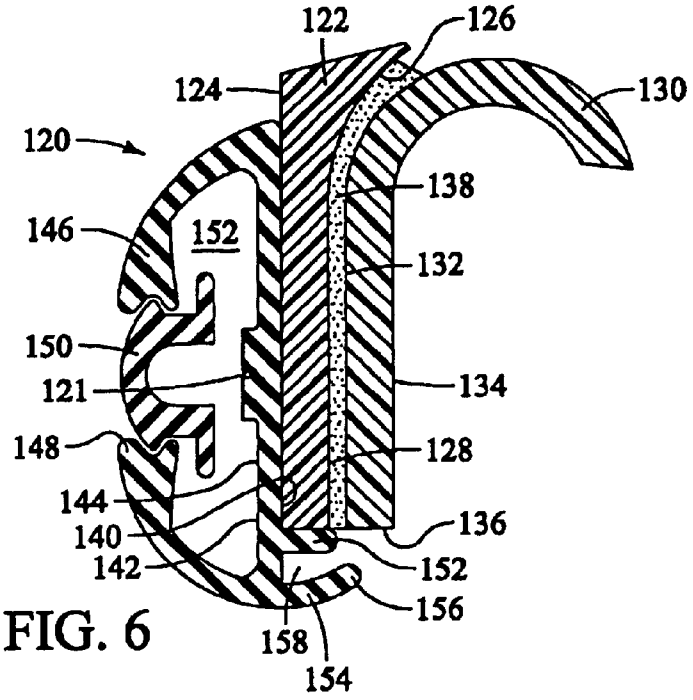

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FIG. 6

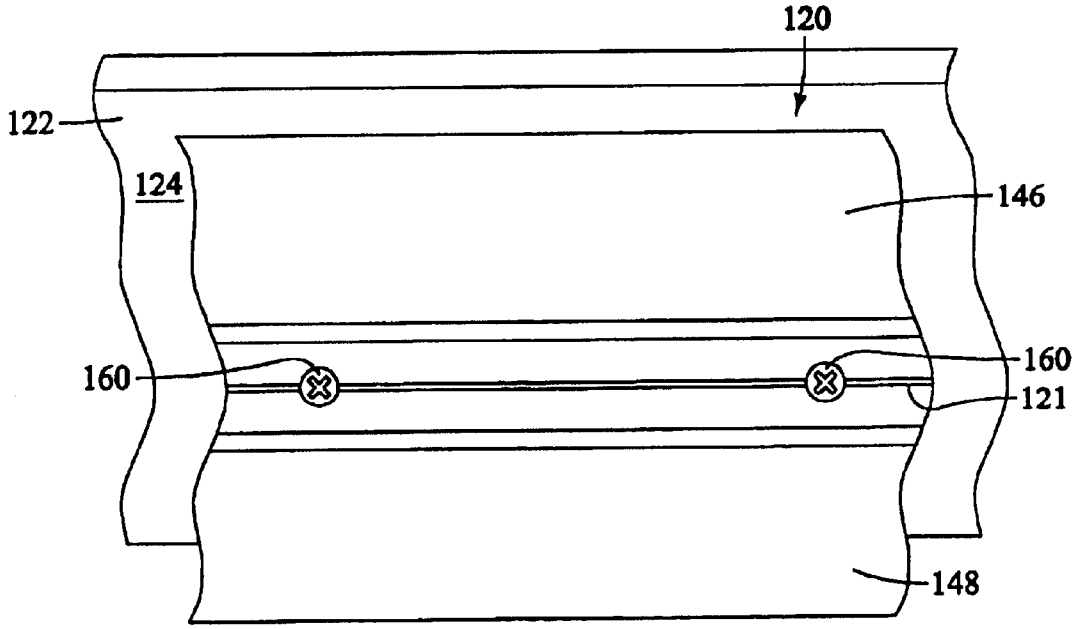
120
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FIG. 7

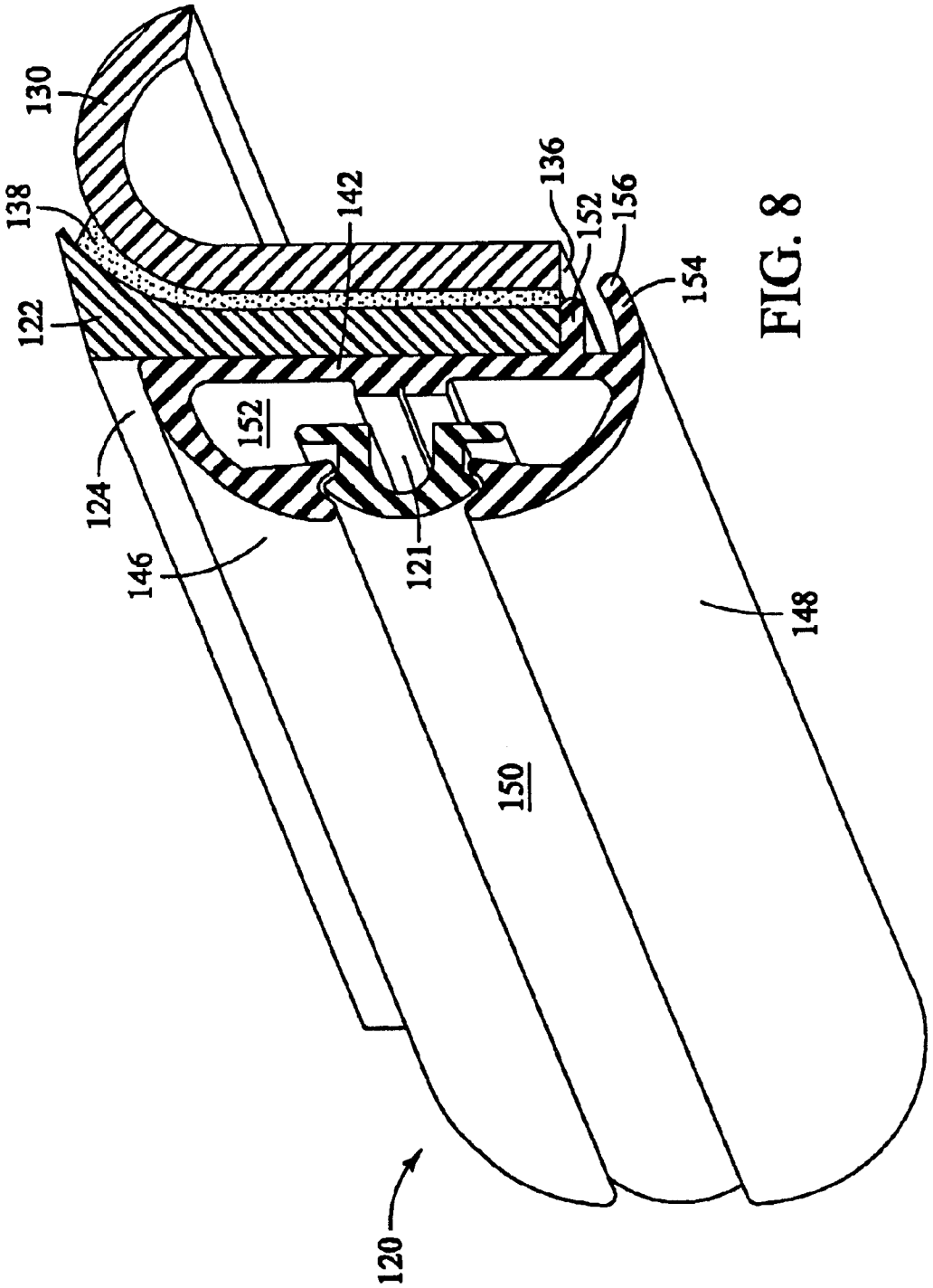

FIG. 8

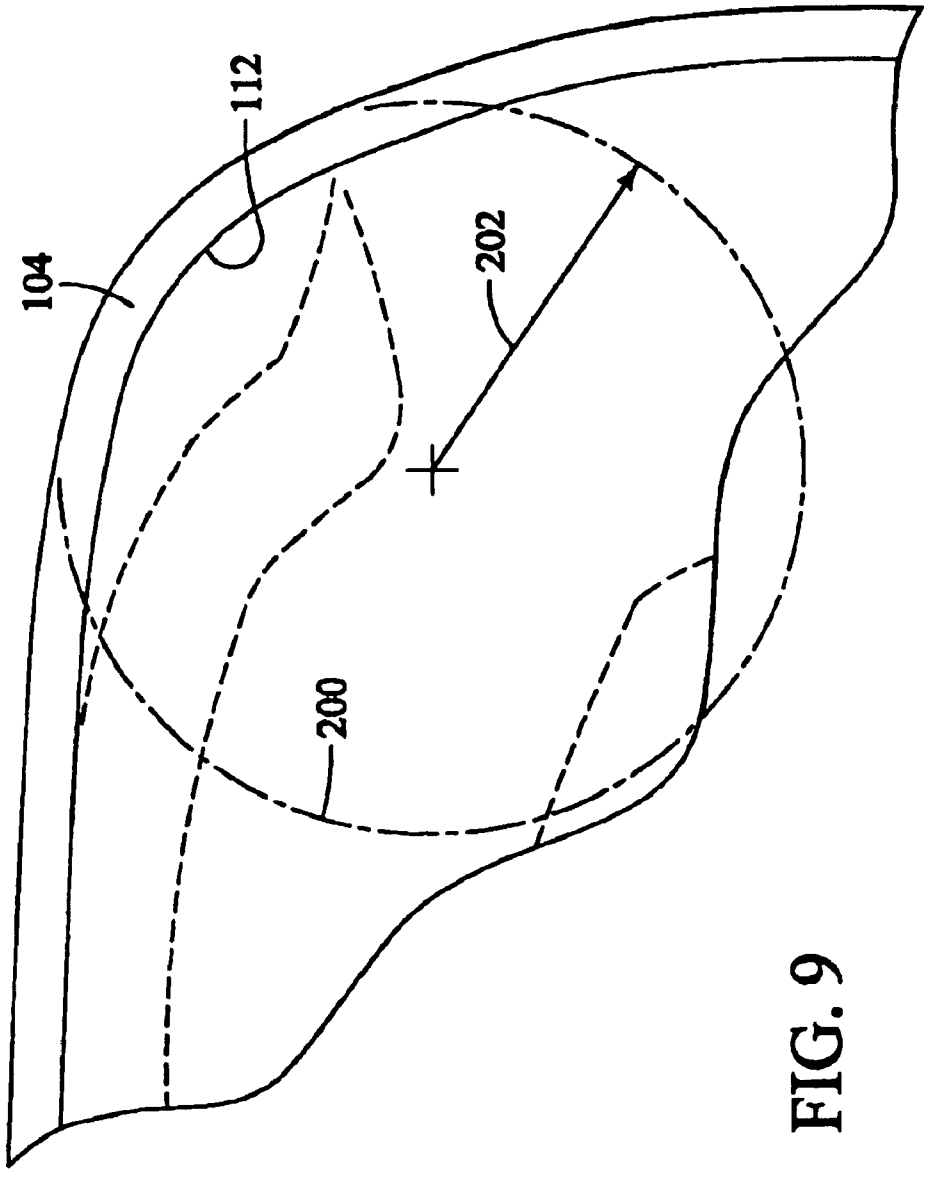

FIG. 9

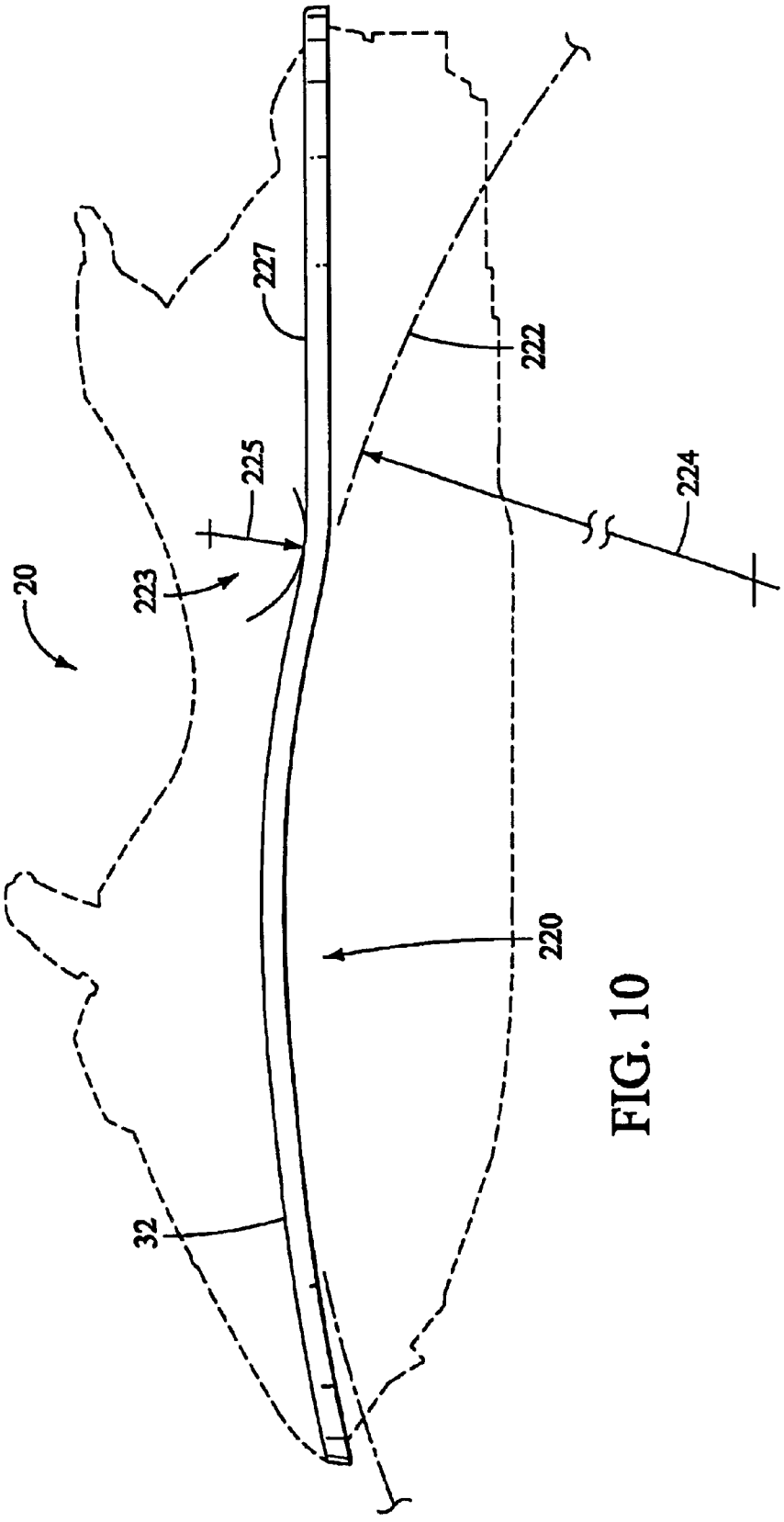

FIG. 10

PERSONAL WATERCRAFT HAVING A PREFORMED RUB RAIL

FIELD OF THE INVENTION

The present invention is related generally to personal watercraft. More specifically, the present invention is related to rub rails on personal watercraft.

BACKGROUND OF THE INVENTION

Personal watercraft (PWC) have become increasingly popular in recent years. A personal watercraft, also known as a "jet ski" typically has a bottom hull, handle bars for steering, a tunnel within the bottom hull, a jet pump located within the bottom tunnel, and an engine within the hull under the top deck for driving the jet pump. The jet pump typically pulls in water from the front of the tunnel under the boat, and discharges the water at high velocity through a steerable nozzle at the rear of the boat. The handlebars are typically coupled to the nozzle, which is the steering mechanism for the personal watercraft. The watercraft commonly has a straddle-type seat and foot wells disposed on either side of the seat.

Personal watercraft typically have a top deck affixed to a bottom hull. The PWC has a shroud mounted in front of the driver on top of the top deck to house the steering column and some instruments. A front portion of the top deck includes a hinged cover or "hood." The underside of the hood can include a gasket or a grommet that attempts to provide a watertight seal between the hood and the top deck. The hood typically covers either a storage bin or an engine access port.

Personal watercraft often have a "rub rail" that can serve as a bumper around the boat. The rub rail can be wrapped around the outer extent of the top deck, to protect the top deck from damage from other boats or docks alongside. Rub rails ideally have some give or resiliency. This resiliency can be provided with a complex lateral or transverse profile. Some such rub rails have an outer wall over a central channel, or a pair of cantilevered wings that provide the resiliency. Rub rails are generally formed using one of two methods. Extrusion can be used to form straight sections of rub rail. A die for the extrusion process can cost on the order of 10,000 dollars, or less. Where straight sections of rub rail are not appropriate, injection molding can be used to form complex curves and rear corner pieces. Injection molds can cost on the order of 100,000 or 200,000 dollars, depending on the complexity. Injection molds cannot easily be used to form certain lateral or transverse shapes. In particular, injection molding cannot easily be used to form a profile that cannot be pulled from the mold, for example, profiles having a central channel or converging cantilevered wings.

Personal watercraft typically have an outer periphery or bow line. This periphery can be formed by the coming together and bonding of the bottom hull to the top deck. Some personal watercraft have a "horizontal bond line", resulting from the top deck and bottom hull extending horizontally and outwardly together over a horizontal segment in which the top deck and bottom hull are bonded together. A rub rail to protect and cover this horizontal bond line can function as a cap, having an upper lip extending over the top deck to support the rub rail and hold it in place. Such a rub rail can have a bottom lip extending under the bottom hull segment as well.

Other watercraft have a "vertical bond line", resulting from the top deck extending downward to terminate in a vertically downward segment. The bottom hull can extend upward to form the hull along the waterline, then extend further upward, then outward in an upside down "U" shape, then downward to terminate in a vertically downward segment alongside and inside of the outer top deck vertically downward segment. The vertically downward segments of the top deck and bottom hull are said to form the vertical bond line.

The vertical bond line typically has a top deck outer vertical surface on which to mount the rub rail. Most vertical bond lines do not provide an upper ridge on which to hang or support the rub rail. The rub rail is typically secured with fasteners of some sort. Rub rails secured to vertical bond flanges are usually, if not always, formed of a rigid material. Forming such a rub rail out of a flexible or even a semi-rigid material can lead to a very soft rub rail after the rub rail has been in direct sunlight for a period of time. If hot and soft enough, the rub rail can even be pulled from and over the fasteners, away from the watercraft. For this reason, rub rails for vertical bond flanges are typically made from rigid polymers, to avoid this tearing and to avoid sagging of the rub rail.

Rigid rub rails can present a problem in that they do not conform to complex surface geometries as easily as semi-rigid or flexible. In particular, vertically curved or bow lines have been difficult to protect with rigid rub rails. Also, rear corners have been difficult to protect with rigid rub rails. One solution has been to make the rub rails for complex curves or corner pieces using injection molding. Injection molding suffers from the cost disadvantage discussed above. Injection molding also can limit the rub rail to shapes that have limited resiliency. Finally, the discrete rear corner pieces formed by injection molding can form a gap or discontinuity where they meet the side rub rail pieces and can be snagged as the discontinuity catches on docks, even pulling the rub rail away from the watercraft. A continuous extrusion could be used that wraps around the rear corners, but current rub rails, if flexible enough to wrap around the rear corners, tend to both wrinkle and to sag on the vertical bond flange.

What would be desirable are watercraft designs that do not require separate rear corner pieces. What would also be desirable are rub rails that are rigid enough to be used on vertical bond flanges without sagging, can be formed using extrusion, and can wrap around rear corners and protect personal watercraft hulls over vertical curves.

SUMMARY OF THE INVENTION

The present invention provides a jet propelled personal watercraft including a hull, the hull having a bottom hull and a top deck secured over the bottom hull, the hull defining an engine compartment sized to contain an internal combustion engine for powering a jet propulsion unit. The personal watercraft also includes a jet propulsion unit including a steerable water discharge nozzle. The top deck can have a raised, longitudinally extending seat adapted to accommodate an operator in straddle fashion. The top deck can have a downwardly extending portion about the watercraft periphery terminating in a bottom edge.

A polymeric rub rail including a vertical portion can be secured to the top deck downwardly extending portion and have an inwardly extending lip disposed beneath the top deck bottom edge, and further have a bottom lip curved upward and inward from the rub rail toward the bottom hull. Some rub rails have a first wing extending downwardly from the rub rail vertical portion and a second wing extending upwardly from the rub rail vertical portion to form an open

channel between the wings and the vertical portion. The converging wings can provide resiliency to the rub rail. In some watercraft, the rub rail is formed of a polymeric material having a Shore A hardness of at least about 90. In other watercraft, the rub rail is formed of a polymeric material having a Shore A hardness of at least about 95. The rub rail can be secured to the top deck over a region having a vertical radius of curvature of less than about 20, 15, or 10 inches, depending on the embodiment.

Some personal watercraft have two, opposite rear corners, wherein the rub rail wraps continuously around at least one of the corners. The rub rail wraps continuously around both rear corners in other personal watercraft, and includes a first corner piece wrapping continuously around a first corner and a second corner piece wrapping continuously around the second corner in still other personal watercraft. The corners can have a radius of curvature of less than 2 feet or 1 foot, in various embodiments. Some watercraft have a rub rail with a vertically curved region. The vertical curve can have a radius of curvature of less then about 20 inches, or even less than 10 inches.

The invention includes methods for securing a polymeric rub rail about a personal watercraft top deck periphery. One method includes providing the personal watercraft, the watercraft having a vertically curved portion of a top deck periphery having a substantially downwardly oriented outer face, and also providing the rub rail, the rub rail having a vertical region for securing to the top deck downwardly oriented outer face. A forming jig can be provided, the jig including substantially the same geometry as the vertically curved personal watercraft top deck section. The rub rail can be heated, then forced to conform to the jig, then allowed to cool, and freed from the jig. The pre-formed rub rail can be secured to the watercraft top deck downwardly extending face. The rub rail can be formed from a rigid material, having a Shore A hardness of at least about 90 or 95, and/or a tensile modulus of at least about 2 GPa.

In some methods, the rub rail has a pair of substantially opposed wings extending outwardly from the rub vertical region and toward each other to form an open channel between the wings and the vertical region. The method can further include inserting a mandrel into the cavity between the wings and the vertical region such that the cavity does not become closed during heating. The heating can be to a temperature of about or above the heat deflection temperature of the polymer in some methods.

The invention can include a rub rail for use on a personal watercraft, the rub rail having a longitudinal dimension, a vertical dimension, and a lateral dimension transverse to the longitudinal and vertical dimensions. The rub rail can have an inward lateral direction to be disposed toward the watercraft and an outward lateral direction to be disposed away from the watercraft. The rub rail can further include a vertical section including an inwardly facing surface for disposition against a personal watercraft peripheral surface, the vertical section having a longitudinally extending mid-region dividing the rub rail into a top region and a bottom region. A first wing can extend outwardly and vertically from the rub rail vertical section. The rub rail can be an extruded rub rail having a Shore A hardness of at least about 90 or 95 and can have a curve along the longitudinal dimension. The curve along the longitudinal dimension can include a vertical curve, a horizontal curve, or a simultaneous vertical and horizontal curve.

The rub rail first wing can extend outwardly and downwardly from the vertical section, and the rub rail can further have a second wing extending outwardly and upwardly from the rub rail vertical section. The rub rail can also have a first lip extending inwardly from the vertical section and a second lip curving upwardly and inwardly from the vertical section.

The present invention includes another rub rail for mounting on a personal watercraft, the rub rail having a longitudinal dimension, a vertical dimension, a lateral dimension transverse to the longitudinal and vertical dimensions, an inward lateral direction to be toward the watercraft, and an outward lateral direction to be away from the watercraft. The rub rail can have a transverse, cross-sectional profile that cannot be made using injection molding, with the rub rail being formed from a rigid material having a tensile modulus of at least about 2.5 GPa and a curve along the longitudinal dimension. The curve can include a vertical curve, a horizontal curve, or both a vertical and horizontal curve.

The present invention provides a method for attaching a rub rail to a personal watercraft, the method including providing a rub rail formed from a rigid material having a tensile modulus of at least about 2.5 GPa and having a transverse profile that cannot be made using injection molding, and also providing a personal watercraft having a substantially vertical peripheral curved surface. The rub rail can be formed to have a rub rail curve substantially matching the watercraft surface curve, such that the rub rail maintains the curve when unconstrained. The pre-formed rub rail can be secured to the watercraft surface. The method can use a rub rail made by extrusion. The method can include providing a forming jig having a jig surface substantially matching the personal watercraft curved surface, wherein the forming includes heating the rub rail, then forcing the rub rail against the jig surface, then cooling the rub rail.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of a prior art personal watercraft having a vertically straight or uncurved rub rail;

FIG. **2** is a top view of a prior art personal watercraft having a discrete front bumper and two discrete injection molded rear corner pieces;

FIG. **3** illustrates a top view of a prior art personal watercraft having a discrete injection molded front bumper and a discrete injection molded rear bumper wrapping around both rear corners;

FIG. **4** is a side view of a personal watercraft having a vertically curved, extruded rub rail;

FIG. **5** is a top view of the personal watercraft of FIG. **4**, having the rub rail wrapped around both rear corners and having a discrete front bumper, two optional side pieces, and a rear middle bumper;

FIG. **6** is a fragmentary, transverse, cross-sectional view of the personal watercraft rub rail of FIG. **4**, having a rub rail insert disposed therein, having the rub rail secured to the top deck which is in turn secured to the bottom hull along a vertical bond flange;

FIG. **7** is a fragmentary, side view of the rub rail of FIG. **6**, with the insert removed, illustrating the rub rail being secured with screws to the top deck;

FIG. **8** is a perspective view of the rub rail, top deck, and bottom hull of FIG. **6**;

FIG. **9** is a fragmentary, top view of a rear corner of the personal watercraft of FIG. **5**, illustrating the rub rail wrapping around a sharp turn having a small radius of curvature; and

FIG. **10** is a schematic side view of the personal watercraft of FIG. **4**, illustrating the rub rail protecting the top deck along a vertical curve having a given radius of curvature.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following detailed description should be read with reference to the drawings, in which like elements in different drawings are numbered identically. The drawings, which are not necessarily to scale, depict selected embodiments and are not intended to limit the scope of the invention. Several forms of invention will be shown and described, and other forms will now be apparent to those skilled in art. It will be understood that the embodiments shown in the drawings and described below are merely for illustrative purposes, and are not intended to limit the scope of the invention as defined in the claims that follow.

FIG. **1** illustrates a prior art personal watercraft **60** having generally a top deck **62**, a bottom hull **64**, and a substantially, vertically straight side rub rail **66**. While the rub rail of personal watercraft **60** may wrap around shallow, horizontal curves of the top deck, little vertical curvature is seen.

FIG. **2** illustrates personal watercraft **60** of FIG. **1** from the top. Personal watercraft **60** may be seen to include a front bumper **68**, and two, rear, injection molded corner pieces **70**. A rear rub rail portion **72** may also be seen. This prior art extruded rub rail, being limited in the ability to wrap around and stay adhered to the watercraft over sharp corners, requires separate injection molded rear corner pieces **70** as illustrated in FIG. **2**. Rigid, injection molded front bumper **68** is required as the rub rail is not able to be wrapped around the sharp bow.

FIG. **3** illustrates yet another prior art personal watercraft **80** having the side rub rail pieces **66** as previously discussed with respect to FIG. **2**, and the separate front bumper **68** also discussed with respect to FIG. **2**. Personal watercraft **80** includes a single, separate, injection molded rear bumper **82** extending around both rear corners and the middle rear of the watercraft.

FIG. **4** illustrates a personal watercraft **20** having generally a front or bow **22** and a rear or stern **23**. Personal watercraft **20** includes a top deck **26** secured to a bottom hull **24** along an overlapping vertical bond flange portion covered with a rub rail **32** in the embodiment illustrated, forming a hull. Rub rail **32** is preferably extruded, rigid, and has resilient wings. A hood **37** may also be seen, joined to top deck **26** at a hinged front hood portion **36**. The hull formed by the bottom hull **24** and top deck **26** define a compartment sized to contain an internal combustion engine **33** for powering the watercraft, and may also include one or more storage compartments, depending upon the size and configuration of the watercraft. The deck portion **26** also has a raised, longitudinally extending seat **28** adapted to accommodate one or more riders seated in straddle fashion on the seat **28**. A grab handle **38** is disposed transversely across the rear of the seat. Engine **33** powers a jet propulsion unit **34**, typically mounted in a tunnel at the bottom rear portion of the watercraft, all shown in phantom in FIG. **4**. Jet propulsion unit **34** includes a steerable water discharge nozzle **29** that is operatively connected to a set of handlebars **42** to facilitate steering of the watercraft by the operator. Handlebars **42** typically mount through a top portion of a shroud **40**. The connection between handlebars **42** and discharge nozzle **29** may be of any suitable type, and typically includes mechanical linkages including a control cable. If desired, an electronic connection could also be utilized.

FIG. **5** illustrates personal watercraft **20** from a top view. Rub rail **32** may now be described in greater detail. Personal watercraft **20** may be seen to have a front bumper **108** wrapped about the bow. To the rear of bumper **108** are two rub rail sections **100** and **101**, both being wrapped about the horizontal curved portions indicated at **110**. In one embodiment, rub rail portions **100** and **101** continue seamlessly rearward to rear bumper **106**, having decorative caps **102** and **103** disposed over the rub rails. In another embodiment, rub rail portions **100** and **101** continue rearward to terminate at discrete side pieces **102** and **103**, on either side of the watercraft. Extending rearward of side pieces **102** and **103** are rub rail portions **104** and **105**, on either side of the personal watercraft. Rub rail portions **104** and **105** extend rearwardly around the rear corners of the watercraft. In another embodiment, rubrail portions **100** and **101** are formed as a single piece, extending as a single piece rearward from portion **100**, then through portions **104**, **106**, **105**, and **101**. In yet another embodiment, a single rub rail piece extends rearward from **102**, through portions **104**, **106**, and **105**, to terminate forwardly at **103**.

A single, rigid, rear center bumper **106** can extend between rub rail corner portions **104** and **105**. The horizontal radius of curvature in the watercraft rear is indicated at **112**. As can be seen from inspection of FIG. **5**, rub rail rear corner portions **104** and **105** are able to hug the top deck around the sharply turning rear outer craft corners.

FIG. **6** illustrates a rub rail section **120**, from a transverse or lateral, cross-sectional view. In FIG. **6**, a longitudinal dimension extends into the paper, a transverse or lateral dimension extends (inwardly) right to left, and a vertical dimension extends top to bottom. Rub rail **120** is disposed against a downwardly extending top deck portion **122**, which is in turn disposed against a downwardly extending bottom hull portion **130** along a vertical bond flange. Top deck **122** is adhered to bottom hull **130** with adhesive, indicated at **138**. Rub rail **120** includes a substantially planar, vertical back region or section **142**. Rub rail vertical region **142** includes an inward surface **140** and an outward surface **144**. Rub rail **120** further includes a first wing **146** extending outwardly and downwardly from rub rail vertical section **142**. Rub rail **120** also includes a second wing **148** extending outwardly and upwardly from rub rail vertical section **142**. First wing **146**, second wing **148**, and rub rail vertical section **142** form an open channel or cavity **152** therebetween. First wing **146** and second wing **148** also form a central longitudinal opening, occupied by a center insert **150** in FIG. **6**.

Top deck **122** includes an outwardly facing surface or face **124**, an inwardly facing surface or face **126**, and a downwardly facing surface or edge **128**. Inwardly facing and outwardly facing surfaces **124** and **126** are substantially downwardly extending, as can be seen from inspection of FIG. **6**. Bottom hull **130** includes an outwardly facing surface or face **132**, an inwardly facing surface or face **134**, and a downwardly facing surface, face, or edge **136**. Top deck **122** may be seen to terminate downwardly in bottom edge **128**. Rub rail **120** may be seen to have an inwardly extending lower lip **152** extending inwardly from rub rail vertical portion **142**. Inwardly extending lip **152** has an upper surface that, in some embodiments, can fit closely to top deck downwardly facing edge **128**. Rub rail **120** may also be seen to have a center longitudinal strip portion **121** that can be used to secure rub rail **120** to top deck **122** using fasteners. Center strip portion **121** can effectively divide rub rail **120** into a top longitudinal region and a bottom longitudinal region.

Rub rail **120** may also be seen to have a bottom, inwardly and upwardly curved lip **154**. Lip **154** terminates in an upwardly and inwardly extending, terminating ridge **156**. An inwardly facing channel **158** may be seen formed between

upwardly and inwardly curved or curled section **154** and inwardly extending rib **152**. Applicants were surprised to discover that the inwardly and upwardly curved rib **154** provided an increased ability for rub rail **120** to hug top deck **122** around sharp corners. In particular, bottom curled rib **154** allowed rub rail **120** to hug top deck **122** around the rather sharp turning rear corners without wrinkling the major outward surfaces of the rub rail. Any wrinkling is forced toward lip **154**. It may be seen from inspection of FIG. **6** that rub rail bottom ridge **156** does not contact either the top deck or the bottom hull, as both top deck **122** and bottom hull **130** have terminated their downward extent locally, well above of curved rub rail region **154**.

FIG. **7** illustrates rub rail **120** from the side. Rub rail first wing **146** and second wing **148** may be seen, having center insert **150** of FIG. **6** removed. The lack of an upper rub rail lip and the lack of an upper ridge for an upper lip may be seen from inspection of FIGS. **6** and **7**. Rub rail center longitudinal mounting region **121** may be seen, having fasteners **160** securing rub rail **120** to top deck **122**. Rub rail **120** may be secured to top deck **122** by disposing the rub rail against the top deck, and moving the rub rail **120** upward until lower lip **152** fits snugly against top deck downwardly facing edge **128**. Fasteners **160** can then be inserted to fasten rub rail **120** to top deck **122**. Center insert **150** can then be inserted to hide fasteners **160**, providing a more aesthetically pleasing appearance.

FIG. **8** illustrates rub rail **120**, from a bottom, perspective view. All numbered elements are as previously described with respect to FIG. **6**. The relationship between the rub rail bottom, inwardly and upwardly curved region **154**, top deck **122**, and bottom hull **130** may be better viewed in FIG. **8**. Rub rail central mounting region **121** of rub rail vertical portion **142** is also better illustrated in FIG. **8**.

FIG. **9** illustrates rear corner **112** and rear corner rub rail **104** of FIG. **5**, in more detail. Rear corner **112** may be seen to have a circle **200** that can be drawn through the outside surface of the rear corner curve of rub rail **104**. The radius of curvature, measured at the outside of the rear corner, is indicated at **202**. Using the rub rail provided by the present invention, a rear corner radius of curvature, or horizontal radius of curvature, less than about 16 inches can be protected by the rub rail of the present invention. In other various embodiments, a radius of curvature of less than 12 inches, or less than 10 inches, can be protected by the rub rail being wrapped about the horizontal curve. In one embodiment of the invention, a rear corner having a radius of curvature of about 8 inches is protected by a rub rail wrapped continuously about the rear corner, not requiring a separate, corner bumper. Having the continuous rub rail protecting the rear corners of the watercraft can prevent problems with snagging, previously seen on other personal watercraft. The corner rub rail regions can be made by extrusion, from rigid material, as described below.

FIG. **10** illustrates personal watercraft **20** of FIG. **4** having rub rail **32**. Personal watercraft **20** may be seen to have a vertically curved rub rail region **220**. The vertically curved rub rail region may be seen to be curved vertically within the plane extending through the rub rail vertical back portion. The vertical curvature of rub rail region **220** can thus force the rub rail to curve or bend along the rub rail back portion, previously described. Bending the rub rail back portion in the vertical direction, as opposed to bending or curving the rub rail transverse to the back portion, can present more of a problem. This is due in part because the rub rail back portion is smaller in a lateral thickness dimension than in a top to bottom vertical dimension. A circle **222** may be drawn through the vertically curved rub rail region **220** and can have a vertical radius of curvature as indicated at **224**. In some embodiments, the vertical radius of curvature is less than about 20 feet. In other embodiments, the vertical radius of curvature is less than about 15 feet. In one embodiment of the invention, the vertical radius of curvature is about 10 feet.

Rub rail **32** also includes a vertically level rear region **227** proceeding forward to a vertically curved region **223** having a vertical radius of curvature as indicated at **225**. In various embodiments, vertically curved region **223** has a vertical radius of curvature of less than 20, 15, and 10 inches, respectively.

The rub rail can be made of any suitable polymeric material, for example, a rigid vinyl or PVC. In various embodiments, the PVC has a Shore A hardness of at least about 90 and/or has a tensile modulus of at least about 2.5 GPa. Some rub rails have a tensile modulus of at least about 0.5 GPa or between about 2.5 and 3 GPa. Other rub rails have a Shore A hardness of at least about 95 and/or a tensile modulus of at least about 1. The rub rail can be manufactured using any well known suitable extrusion technique. The rub rail can be any suitable height and thickness, depending on the watercraft. Some rub rails are about 2 inches in height, having a wall thickness of between about ⅛ and ½ inch.

In preferred embodiments, the rub rails are preformed to match the desired geometry of the watercraft. The rub rail can be formed using an extrusion method to create the desired profile, for example, the cross-section as seen in FIG. **6**. A forming jig having substantially the same geometry as the watercraft rear corners or the front, horizontally and vertically curving region, can be made out of any material able to serve as a forming surface or structure. The extrusion can be heated to soften the extrusion, then forced to assume the shape of the forming jig. In one embodiment of the invention, the extrusion and jig are heated together to a temperature of about, or above, the heat deflection temperature of the polymer. The forming jig and the extrusion can then be allowed to cool. After cooling, the now preformed extrusion can be removed from the forming jig, having approximately the shape of the top deck region to which it is to be affixed. In one method, a flexible insert is inserted into the cavity or open channel formed between the wings and the back vertical portion of the extrusion. This insert or mandrel can be used to prevent the wings from collapsing in upon the vertical back side during heating, which would or could, shrink or close the wings to totally remove the open channel. In some methods, the insert is a vinyl, flexible insert. In such methods, the jig, extrusion, and insert or mandrel can be heated together, to maintain the desired internal cavity or open channel of the extrusion. After cooling, the flexible insert or mandrel can be removed.

Inspection of FIGS. **4**, **5**, and **10**, show that rub rail front vertically curved region **220** is also horizontally curved. The simultaneous vertical and horizontal curving is also provided by the preformed rub rail and processes described above.

What is claimed is:

1. A jet-propelled personal watercraft comprising:

a hull including a bottom hull and a top deck secured over the bottom hull, the hull defining an engine compartment sized to contain an internal combustion engine for powering a jet propulsion unit, the jet propulsion unit including a steerable water discharge nozzle, the top deck having a raised, longitudinally extending seat adapted to accommodate an operator in straddle fashion,

the top deck having a downwardly extending portion about the watercraft periphery terminating in a bottom edge; and

a polymeric rub rail including; a vertical portion secured to the top deck downwardly extending portion and having an inwardly extending lip disposed beneath the top deck bottom edge and further having a bottom curved lip curving upward and inward from the rub rail toward the bottom hull.

2. A personal watercraft as in claim **1**, wherein the rub rail has a first wing extending downwardly from the rub rail vertical portion and a second wing extending upwardly from the rub rail vertical portion to form an open channel between the wings and the vertical portion.

3. A personal watercraft as in claim **1**, wherein the rub rail is formed of a polymeric material having a Shore A hardness of at least about 90.

4. A personal watercraft as in claim **1**, wherein the rub rail is formed of a polymeric material having a Shore A hardness of at least 95.

5. A personal watercraft as in claim **1**, wherein the rub rail is secured to the top deck over a region having a vertical radius of curvature of less than about 20 feet.

6. A personal watercraft as in claim **5**, wherein the nib rail has a Shore A hardness of at least about 90.

7. A personal watercraft as in claim **1**, wherein the rub rail is secured to the top deck over a region having a vertical radius of curvature of less than about 30 feet.

8. A personal watercraft as in claim **7**, wherein the rub rail has a Shore A hardness of at least about 90.

9. A personal watercraft as in claim **1**, wherein the personal watercraft has two, opposite rear corners, wherein the rub rail wraps continuously around at least one of the corners.

10. A personal watercraft as in claim **9**, wherein the rub rail wraps continuously around both rear corners.

11. A personal watercraft as in claim **9**, wherein the rub rail includes a first corner piece wrapping continuously around a first corner and a separate second corner piece wrapping continuously around the second corner.

12. A personal watercraft as in claim **9**, wherein the corner has a radius of curvature of less than about 2 feet.

13. A personal watercraft as in claim **9**, wherein the corner has a radius of curvature of ls than about 1 foot.

14. A personal watercraft as in claim **1**, wherein the rub rail has a vertically curved region.

15. A personal watercraft as in claim **14**, wherein the rub rail vertically curved region has a radius of curvature of less than about 20 inches.

16. A rub rail for use on a personal watercraft, the rub rail having a longitudinal dimension, a vertical dimension, and a lateral dimension transverse to the longitudinal and vertical dimensions, wherein the rub rail has an inward lateral direction to be disposed toward the watercraft and an outward lateral direction to be disposed away from the watercraft, the rub rail comprising:

a vertical section including an inwardly facing surface for disposition against a personal watercraft peripheral surface, the vertical section having a longitudinally extending mid-region dividing the rub rail into a top region and a bottom region; and

a first wing extending outwardly and vertically from the rub rail vertical section;

wherein the rub rail is an extruded rub rail having a Shore A hardness of at least about 90;

wherein the rub rail has a curve along the longitudinal dimension including a vertical curve.

17. A rub rail as in claim **16**, wherein the vertical curve has a vertical radius of curvature of legs than about 20 inches.

18. A rub rail as in claim **16**, wherein the curve along the longitudinal dimension includes a horizontal curve.

19. A rub rail as in claim **18**, wherein the horizontal curve has a horizontal radius of curvature of less than about 2 feet.

20. A rub rail as in claim **16**, wherein the rub rail has a Shore A hardness of at least about 95.

21. A rub rail as in claim **16**, wherein the rub rail first wing extending outwardly and vertically extends outwardly and downwardly from the vertical section, the tub rail further having a second wing extending, outwardly and upwardly from the rub rail vertical section.

22. A rub rail as in claim **16**, wherein the rub rail has a first lip extending inwardly from the vertical section, and a second lip curving upwardly and inwardly from the vertical section.

23. A rub rail as in claim **16**, wherein the rub rail comprises PVC.

24. A rub rail as in claim **16**, wherein the rub rail comprises PVC having a tensile modulus of at least about 2 GPa.

25. A rub rail for mounting on a personal watercraft, the rub rail comprising:

a longitudinal dimension;

a vertical dimension;

a lateral dimension transverse to the longitudinal and vertical dimensions;

an inward lateral direction to the toward the watercraft;

an outward lateral direction to be away from the watercraft;

wherein the rub rail includes a transverse, integrally formed cross-sectional profile that includes a substantially vertical back section and at least one wing extending outwardly and vertically from the back section;

wherein the rub rail is formed from a rigid material having a tensile modulus of at least about 2 GPa; and

a curve along the longitudinal dimension including a vertical curve.

26. A rub rail as in claim **25**, wherein the curve includes a horizontal curve.

27. A rub rail as in claim **25**, wherein the curve is a vertical and horizontal curve.

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