The invention is directed to a watercraft hull design that comprises a hull having a bow, stern, top, and bottom. A wedge-shaped wave spreading system is located at a forward portion of the craft. The wave-contacting surface planes of the wave spreading system are positioned substantially perpendicular to the plane of smooth water. The bottom edge of the wave spreading system is positioned near the level of smooth water when the watercraft is at cruising speed. The wave spreading system has a forward apex which forms a substantially perpendicular or vertical leading wedge to the plane of water. Since the apex and planes of the wave spreader are substantially perpendicular to the water, oncoming waves encountered by the wave spreader will tend to be deflected horizontally. Accordingly, the watercraft will more easily "cut through" waves instead of riding over them. Located rearwardly of the wave spreader, an internal hull prow is spaced from the wave spreading system, creating an air space therebetween. The air space extends from the rearward surface of the wave spreader to the front of internal hull prow, creating a buffer zone or dampening space to further minimize any wave action not detected by the spreading system.
WATERCRAFT WITH WAVE DEFLECTING HULL

CROSS-REFERENCE TO RELATED APPLICATIONS/INCORPORATION BY REFERENCE


TECHNICAL FIELD

[0002] The present invention relates generally to watercraft. More specifically, the present invention relates to watercraft hulls designed to displace water in a manner to provide enhanced stability and movement through the water.

BACKGROUND OF THE INVENTION

[0003] Conventional recreational and commercial watercraft, for the most part, incorporate hulls which have V-shaped bottoms, with the V-shape, at its lowest point, forming a keel. The V-shape is thought to enable the boat, as speed is increased, to be pushed upwardly out of the water, as the water traversing against the boat's bow is forced sideways and downwardly at a vector to the outer shape of the hull. Such designs have been used for years, but have various deficiencies.

[0004] One detriment to such hull designs is that the draft of the boat tends to sit relatively deep in the water in relation to the length and beam of the boat, thus requiring sufficient depth of water to accommodate that draft. Another detriment to such hull designs is that they require a relatively large amount of force (and horsepower) to propel such a boat forward at a sufficient speed to stabilize the boat, i.e., to force the water sideways and downwardly as the boat travels generally horizontally through the water.

[0005] With V-shaped hull designs, initially, as velocity begins to increase from zero, the bow of the boat acts much like a plow, digging into and through the surface of the water. This creates what is known as a "bow wave". As velocity increases more, the bow tends to be forced upwardly by the sideways and downward force being applied to the water by the curvature of the V-shape of the hull being forced horizontally forward and up over the bow wave.

[0006] Finally, when sufficient velocity is approached and then reached, the apex of the force on the V-shaped hull travels aftwardly along the hull, forcing the boat more upwardly to an increasing degree until a point is reached at which the bow, now out of the water, tends, by force of gravity, to descend toward the water, pivoting on the apex of the force against the sides and bottom of the V-shaped hull. This pivoting serves to raise the stern of the boat as the bow descends until the whole boat is lifted upwardly into what is known as a planing position. At this point, because there is relatively less water contacting the hull, drag from that water is reduced and the boat is correspondingly able to go significantly faster given the same amount of force propelling the boat forward.

[0007] Of course, as might be anticipated, the hydraulic force of the water against the V-shaped hull is substantial, and thus at least an equally substantial counteracting force must be provided by the engine of the boat. Significant power is required to get the boat up to the planing position and to maintain it there. The ultimate speed of the boat, when planing, depends on the specific design of the V-shaped hull, the weight (and weight distribution) of the boat, and the available power, i.e., the size of the engine and the size and pitch of the propeller which is driven by the engine. However, in all cases, the forward movement of the boat, at any speed, whether up on plane or not, is counteracted by both sideways and downward vectors of force produced by the relative hydraulic movement of the water against the hull.

[0008] The amount of fuel needed to power a boat at a given velocity is in direct proportion to the overall degree of each of the forces needed to be overcome to move that boat forward over a given distance. The greater those forces, the greater will be the amount of fuel consumed. Thus as a general proposition, if fuel economy is a concern, hull designs are desirable which tend to reduce the overall amount of opposing forces directed against the hull during forward movement of the boat. One approach to this is the use of relatively flat bottom hulls wherein there is less counteracting hydraulic force imposed against the hull as the boat moves forward. A flat hull is more readily pushed directly up over the bow wave to a position substantially on top of the water, creating less displacement of water by the hull in the dynamic mode as distinguished from the static mode. In other words, dynamic displacement of water is significantly less with a flat bottom boat than with a V-shaped bottom. On the other hand, static displacement, when the boat is at rest, is substantially the same for a flat bottom or a V-bottom boat, giving equivalent boat weights and hull surface contact with the water.

[0009] Watercraft or boats with flat bottom hulls have been known for years. Small fishing boats have been manufactured using this design. Such boats have a relatively shallow draft to enable sports fishermen to get into shallow waters along shorelines, into shallow, swampy areas, and into lakes, ponds and streams which are not sufficiently deep to accommodate the draft of conventional V-bottom boats.

[0010] Such designs have evolved into what are popularly called "bass boats". Bass boat hulls are relatively narrow, in relation to length, with generally flat bottoms and relatively shallow V-shapes, if any. The draft of these boats is relatively shallow in comparison to V-shaped hulls. Once up on a plane, the vector force of the water is mostly downwardly, forcing these boats to rise up out of the water to a greater degree at relatively slower speeds, thus ultimate velocity can be greater, and relatively less engine power may be required to reach a given velocity.

[0011] The down side is that, because bass boats are relatively narrow beamed and because there is relatively little sideways or lateral force being exerted against the hull of a bass boat, there is correspondingly less lateral stability, and, due to a relatively narrow beam, such boats tend to be susceptible to laterally moving waves. Such flat bottom hulls are also generally more susceptible to waves as the hull rides more on top of the waves rather than slicing somewhat through waves as V-shaped hulls do to a greater degree. Also, such boats do not steer as easily or as precisely as those with distinct, V-shaped hulls, due again to the fact that such boats incur relatively less opposing sideways forces, being those forces which tend to hold a boat to a straight forward move-
ment. Such forces if present can be precisely altered by a rudder device at the stern. Therefore, when steered to turn, bass boats tend to skid laterally sideways more readily, thus making turning a much less precise and controllable skidding action, rather than the positive, more precisely controllable action of V-shaped hulls. Bass boat designs rarely incorporate sponsons, thus, for the sake of safety, it is almost necessary to slow some high-powered bass boats down before turning, to both effect a more precise turn and to prevent the boat from flipping over.

Both types of hulls are susceptible to wave action and may produce instability depending on the height and direction of waves. Both types of hulls have large surfaces which absorb the force of waves, and cause significant vibration, vertical or lateral movement, or a combination of these. Other boats include hull designs which incorporate pontoons or sponsons for lateral stability and flotation, but such systems are undesirable for a number of reasons.

There is thus a need for a watercraft that overcomes the deficiencies of the prior art, and efficiently maneuverable in the water, while providing increased fuel efficiency and a smooth, stable ride, even in rough water.

SUMMARY OF THE INVENTION

The invention is therefore directed to a watercraft hull design that overcomes the deficiencies of prior designs. The watercraft comprises a hull having a bow, stern, top, and bottom. A wedge-shaped wave-spreading multi-hull at a forward portion of the craft. The wave-contacting surface planes of the wave spreading hull system are positioned substantially perpendicular to the plane of smooth water, at least adjacent the water surface.

The wave spreading hull portions have a forward apex which forms a substantially perpendicular or vertical leading wedge to the plane of water. Since the apex and planes of the wedge shaped hull portions are substantially perpendicular to the water, oncoming waves encountered by the hull portions will tend to be deflected horizontally. Accordingly, the watercraft will more easily “cut through” waves instead of riding over them.

Located rearwardly of the wave spreaders, an internal hull prow portion is spaced from the wave spreading surfaces, creating an air space therebetween. The air space extends from the rearward surface of the wave spreader to the front of internal hull prow, creating a dampening space to further minimize any wave action not deflected by the hull portions. The internal hull prow portion extends to a flat-bottomed section of the hull. The air space further eliminates any surface that would tend to ride up on a wave.

The portion of the hull that contacts water while the watercraft is at cruising speed is spaced rearwardly of the air space. This portion of the hull that contacts the water is generally flat, as opposed to the V-shape commonly found in watercraft. This flat-bottomed hull enables the watercraft to easily reach a plane, while displacing a smaller amount of water than typical V-shaped hulls. The multi-hull design according to the invention also facilitates displacement of water between hulls, to further minimize forces acting on the boat.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a watercraft and hull in accordance with an embodiment of the present invention.

FIG. 2 is a back perspective view of a watercraft and hull of FIG. 1.

FIG. 3 is a schematic bottom view of an embodiment of a hull design according to the invention.

FIG. 4 is a schematic bottom view of an alternate embodiment of a hull design according to the invention.

FIG. 5 is a schematic bottom view of an alternate embodiment of a hull design according to the invention.

FIG. 6 is a schematic bottom view of an alternate embodiment of a hull design according to the invention.

FIG. 7 is a side view of a wave slicer and a splash guard in accordance with an embodiment of the present invention.

FIG. 8 is a schematic bottom view of an alternate embodiment of a hull design according to the invention.

FIG. 9 is a side view of a center hull design according to the invention.

FIG. 10 is a schematic bottom view of an alternate embodiment of a hull design according to the invention.

FIG. 11 is a side view of a center hull design according to the embodiment of FIG. 10 of the invention.

DETAILED DESCRIPTION

Reference will now be made in detail to an embodiment of the invention as illustrated in the accompanying drawings.

Turning to FIGS. 1-2, an embodiment of a watercraft, generally identified by reference number 10, is illustrated. The watercraft 10 comprises a hull 12 having a bow 14, stern, 16, port side 18, and starboard side 20. The watercraft 10 may be built out of aluminum or a formed hull or sheets with welded seams. The hull 12 and other portions of watercraft 10 could also be fabricated from other materials such as, for example, FRP, high-density polyethylene, other metals, or other suitable materials.

As illustrated in FIGS. 1 and 2, and with reference to the schematic of the hull configuration in FIG. 3, the watercraft 10 comprises a hull 12 which is designed to cut through waves or wakes of other boats, and minimize the forces acting on the hull to reduce the pounding experienced with typical hull designs. The hull 12 further reduces lateral action on the hull which produces pitching. The hull 12 is of a multi-hull configuration, having first and second outer deep V-hulls 22 (only one shown in FIG. 1) and a central wave-deflecting hull 24. The hulls 22 and 24 each have a unique configuration to allow the above advantages to be realized. A gunwale 15 is mounted above hull 12, and a windshield 17 is mounted above the gunwale and toward the bow 14. The gunwale 15 has side rails 19, forming a passenger compartment for use of the boat 10. A motor mount 21 is provided for mounting of a boat motor 23 to propel the watercraft 10.

The hull portions 22 and 24 each have a very narrow profile, and outer hulls 22 each have a pointed V-shaped front-end wave spreading structure 26. The central hull 24 extends forward of the outer hulls 22, and has a wave spreading structure 25 associated therewith. The extent that the central hull 24 extends forward of the outer hulls 22 can vary depending on the size of the watercraft 10, and the type of water body the craft is designed to operate in. In general, the central hull 24 length may be from between 5 to 25% greater than the outer hull lengths. With reference to FIG. 3, the hull 24 is configured to have a substantially flat bottom portion 28, with a upwardly tapered front end 30. The front end 30 would normally be exposed to oncoming waves, but in
the present invention, the wave spreading structure 25 deflects any waves away from the portion 30. This results in the hull portions 30 and 28 being recessed or internal to the wave contacting surfaces of the hull 12. The wave spreading structure 25 may be formed of sheet material, configured into a wedge shape having first and second sides 32 and 34 and a front edge 36 directed forwardly. The sides 32 and 34 of the wedge shape present substantially vertical surfaces to facilitate water displacement, resulting in a configuration that cuts through any waves, minimizing wave forces acting on the hull 12. This also results in the boat 10 remaining substantially level as it moves across the water, even if waves or wake are encountered. Further, the boat 10 remains substantially level at different speeds when on plane, even if loaded. The sides 32 and 34 extend toward the rear of boat 10, forming a cavity behind the front edge 36. The sides 32 and 34 may extend to a position which is adjacent the position that water contacts the internal prow formed by the portions 28 and 30 as the boat 10 moves across the water. The sides also extend toward the water to a position just above the level of smooth water as the boat 10 moves through the water.

Each hull portion 22 is also formed with a large, somewhat vertical front edge profile, presenting the approaching water with a knife-edge-type profile of type. This edge cuts through any waves or wake and displaces water laterally of each hull portion 22 along with the wave spreader 25 associated with center hull 24. From the front edges 26, the hull portions 22 are formed to have substantially flat bottoms 40 with a slightly upward taper 27 formed at the forward end of each hull 22 to facilitate water displacement and planing of the boat during operation. The front edge 26 and forward side sections 29 of the hull portions 22 form v-shaped or wedge shaped portions which present somewhat vertically oriented wave spreading surfaces. Each hull portion 22 acts to spread waves laterally of the boat, and into the spaces 23 between hull sections. The spaces 23 between hulls 22 and 24 are designed to accommodate the volume of water displaced by the hulls based upon the size of the boat.

The wave spreading hull portions 22 may extend to a position that is spaced rearwardly from the front of center hull 24, such that oncoming waves are first contacted by center hull 24, and subsequently contacted by the hulls 22. The hulls 22 are configured to cut through and deflect with minimal resistance, the initially deflected oncoming waves, before contacting the remaining portions of hull 12. The hull portions 22 are designed such that the forward sections are positioned just above the smooth water level when the craft is in operation, such that smooth water will not impose substantial forces on the hull portions 22. Oncoming waves are spread and directed immediately away from craft 10 by the substantially vertically oriented wedge surfaces 34 and 36 of hull portion 24, and the surfaces 29 of hull portions 22, which cut through and deflect water with less drag than other hull configurations. The height of the apex 26 of portions 22 and 24 may be suitable for the environment in which the watercraft 10 is to be used. Each front edge 26 on hulls 22 and 24 are designed to extend out of flat water to a height above any expected waves based on the size of boat and type of water bodies such a boat would be operated in. For example, for watercraft adapted for use in larger bodies of water with larger waves, the vertical height of the forward sections of portions 22 and 24 may have a greater height.

Since the wave spreading configuration of each hull portion 22 and 24 is designed to deflect oncoming waves substantially horizontally, the wave-contacting surface planes 34 and 36 are preferably substantially perpendicular, to the smooth water surface while the watercraft is at cruising speed. However, it is also contemplated that the wave-contacting surface planes of the portions 22 and 24 may be scooped or at a slight acute or obtuse angle to the smooth water while the watercraft is at cruising speed. For example, a slight obtuse angle between the plane of smooth water and the wave-contacting surface planes of the wave spreader 25 will tend to deflect oncoming waves more upwardly and therefore increasingly drive the watercraft through the waves.

Referring again to FIG. 3, and the hull portion 24, there may be formed an air cavity 38 located rearwardly of the wave spreader 30. The air cavity 38 facilitates minimizing any pitching and pounding against the waves by eliminating forward hull surfaces that would tend to ride up on or pound against waves. The air cavity 38 extends from the upper edges of the hull portion 24 in a sloped configuration which terminates at the internal hull prow 30. Internal hull prow 30 comprises the forward end of the hull bottom, and extends into the substantially flat-bottomed section 28. In this embodiment, internal hull prow 30 is located at approximately sixty percent (60%) of the length of hull 12 as measured from the stern 14, but lengths between approximately 50 to 90% are contemplated. The length of hull bottom 28, and thus the location of internal hull prow 30, can vary further for more particular designs associated with different applications or particular environments within the scope of the present invention. Due to the wave spreading action of the hulls 22 and 24, in general, internal hull prow 30 encounters mostly smooth water. If desired to provide further surface for deflection of any wave, the wave contacting surface planes of internal hull prow 30 may be formed in a slight v-bottom configuration, but forming a substantially flat bottom 28 toward the stern 16 of craft 10.

The hull bottom 28 is located aft of the air cavity 38. A problem with conventional flat-bottomed watercraft has been their tendency to pitch and roll upon encountering waves. With the present invention, this problem is greatly reduced by the wave spreading hull portions 22 and 24. As the surfaces 34 and 36 spread or deflect oncoming waves substantially horizontally away from the hull 12, waves which would tend to cause a flat bottomed to pitch up are reduced significantly.

The hull bottoms 28 and 40 generally provides a large flat surface transitioning from the forward wave-deflecting surfaces or from internal prow 30, such that the hull displaces less water than conventional v-bottomed hulls at cruising speed. The smaller displacement of water enables the watercraft to cruise higher in the water, as compared to conventional v-bottomed watercrafts. Additionally, the watercraft leaves a smaller wake and requires less power for propulsion. Therefore, fuel economy is increased as compared to conventional v-bottomed boat hulls. Further, at the stern 16 of the craft 10, the bottoms 40 of the outer hulls 22 extend to a position rearward of the rear wall or motor mount 21, to extend the flat bottom surface which rises on the water during operation. The center hull 24 is then configured such that the bottom surface 28 terminates before reaching the stern. Water deflected by the wave deflecting surfaces of hulls 22 and 24, is thereby channeled through the spaces 23 between hulls, and at the stern, only the outer hulls have bottom surfaces contacting the water, to provide a relief zone between hulls 22 at the rear of the craft 10. An upwardly angled transition surface
extends from the stern to the bottom surface 28 at the rear of bottom surface 40 to the gunwale and back wall 21.

[0039] In this embodiment of the watercraft 10 and hull 12, each of the hull portions 22 and 24 has at its top end, upwardly angled transition surfaces 42 and 44, extending from the apex 26. If waves are encountered which extend up to this height, these surfaces 42 and 44 will also deflect waves away from the hull. Further, to facilitate stabilizing the craft 10 in the water, whether under power or at rest, each hull portion 22 and 24 may be formed in sections, with a lower section being substantially vertically oriented relative to smooth water, and upper sections which are angled outwardly to form a larger water displacing structure.

[0040] Turning to FIG. 4, an alternate embodiment of the hull configuration is shown at 100, and again may comprise a central hull 104 and two outer hulls 102, each of which has a wave spreading structure 105 associated therewith. In this embodiment, the wave spreading structure 105 of the outer hulls 102 and central hull 104, extends to approximately the same forward position, such that each will engage and deflect waves. As in the prior embodiment, the hull portions 102 and 104 may be configured to have a substantially flat bottom portions 106 and 108, with an upwardly tapered front ends 110 and 112 respectively. The front ends 110 and 112 would normally be exposed to oncoming waves, but in this embodiment, the wave spreading structures 105 deflect any waves away from the portions 110 and 112. This results in the hull portions being recessed or internal to the wave contacting surfaces of the hull 12. The wave spreading structures 105 may again be configured as a wedge shape having first and second sides 114, 116 and a front edge 118 directed forwardly. The sides 114 and 116 of the wedge shape present substantially vertical surfaces to facilitate water displacement, resulting in a configuration that cuts through any waves, minimizing wave forces acting on the boat 100. This also results in the boat 100 remaining substantially level as it moves across the water, even if waves or wave are encountered. Further, the boat 10 remains substantially level at different speeds when on plane, even if loaded. The sides 114 and 116 extend toward the rear of the boat 100, forming a cavity behind the front edge 118. The sides 114 and 116 may extend to a position which is adjacent the position that water contacts the internal prow formed by the portions 110 and 112 as the boat 10 moves across the water. The sides also extend toward the water to a position just above the level of smooth water as the boat 100 moves through the water. Each hull portion 102 and 104 acts to spread waves laterally, and into the spaces 120 between hull sections. The spaces 120 between hulls are designed to accommodate the volume of water displaced by the hulls based upon the size of the boat.

[0041] Turning to FIG. 5, an alternate embodiment of the hull configuration is shown at 150, and may comprise first and second outer hulls 152 and 154, each of which has a wave spreading structure 155 associated therewith. In this embodiment, the wave spreading structure 155 of the outer hulls 152 and 154, extend to a forward position of the hull, such that each will engage and deflect waves away from the other portions off hull. As in the prior embodiments, the hull portions 152 and 154 may be configured to have a substantially flat bottom portions 156 and 158, with an upwardly tapered front ends 160 and 162 respectively. The front ends 160 and 162 would normally be exposed to oncoming waves, but in this embodiment, the wave spreading structures 155 deflect any waves away from the portions 160 and 162. This results in the hull portions being recessed or internal to the wave contacting surfaces of the hull. The wave spreading structures 155 may again be configured as a wedge shape having first and second sides 164, 166 and a front edge 168 directed forwardly. The sides 164 and 166 of the wedge shape present substantially vertical surfaces to facilitate water displacement, resulting in a configuration that cuts through any waves, minimizing wave forces acting on the boat. This also results in the boat remaining substantially level as it moves across the water, even if waves or wave are encountered. Further, the boat remains substantially level at different speeds when on plane, even if loaded. The sides 164 and 166 extend toward the rear of boat 150, forming a cavity behind the front edge 168. The sides 164 and 166 may extend to a position which is adjacent the position that water contacts the internal prow formed by the portions 160 and 162 as the boat 150 moves across the water. The sides also extend toward the water to a position just above the level of smooth water as the boat 150 moves through the water. Each hull portion 152 and 154 acts to spread waves laterally, and into the spaces between hull sections. The spaces 170 between hulls are designed to accommodate the volume of water displaced by the hulls based upon the size of the boat.

[0042] Turning to FIG. 6, an alternate embodiment of the hull configuration is shown at 250, and may comprise first and second outer hulls 252 and 254, each of which has a wave slicing structure 225. The hull portions 252 and 254 may be configured to have a substantially flat bottom portions 256 and 258. The first and second outer hulls 252 and 254 may be configured as a wedge shape having first and second sides 264, 266 and a front edge 268 directed forwardly. The sides 264 and 266 of the wedge shape present substantially vertical surfaces to facilitate water displacement, resulting in a configuration that cuts through any waves, minimizing wave forces acting on the boat. This also results in the boat remaining substantially level as it moves across the water, even if waves or wave are encountered. Further, the boat remains substantially level at different speeds when on plane, even if loaded. The sides 264 and 266 extend toward the rear of hull 250, and when on plane, the hull portions 252 and 254 ride substantially on top of the water due to the flat, ski-like bottom portions 256 and 258. The sides 264 and 266 are then positioned at about the level of smooth water as the hull 250 moves through the water. Each hull portion 252 and 254 acts to spread waves laterally, and into the space outside or between hull sections. The space 270 between hulls portion 252 and 254 may be designed to accommodate the volume of water displaced by the hulls based upon the size of the boat. Further, the wave slicing structures 225, as shown in FIG. 7, extend from the front portion of the flat bottom portions 256 and 258. The wave slicing structures 225 may be configured to have a front edge 268 which is oriented in a substantially vertical position, and transitions to be substantially horizontally oriented at the rear thereof. The slicing structure 225 therefore has a triangular shape wherein the two sides of the triangle shape are substantially vertical at the front edge 268 and transition to a substantially horizontal position at the rear which is substantially flat against the flat bottom portions 256 and 258. The wave slicing structures 225 generate a vortex in the water that forces water to the bottom and outside edge of outer hulls 252 and 254. The water is then forced by gravity back into the water and not into the boat’s cockpit. This slicing structure may be termed a wave diffusion system. Further, splash guards 271 may be provided to extend out-
wardly from the front portion of the outer hulls 252 and 254. The splash guards 271 extend rearwardly from the front edge 268, and may be above the surface of the water. Each splash guard 271 blocks any water that is forced upward due to the interaction between the hull 250 and the water.

[0043] Turning to FIG. 8, an alternate embodiment of the hull configuration is shown at 350, hull portions 322 and 324 each have a narrow flat profile and a wave slicing structure 355. The outer hulls 322 each have a pointed V-shaped front-end wave spreading structure 326. The central hull 324 extends forward of the outer hulls 322, and the front portion of the central hull 324 includes a wave spreading structure 325. The extent that the central hull 324 extends forward of the outer hulls 322 can vary depending on the size of the watercraft 10, and the type of water body the craft is designed to operate in. In general, the central hull 324 length may be from between 5 to 25% greater than the outer hull 322 lengths. The hull portions 322 and 324 are configured to have a substantially flat bottom portion 340 and 328, respectively. On the outer hull portions 322, the substantially flat bottom portion 340 begins at the front edge 326 and extends rearwardly to the rear of hull portions 322. On the center hull 324, the flat bottom portion 328 begins at a front edge 336 of the wave spreading structure 325 and extends rearwardly to the rear of the central hull 324. The center hull portion 324 has a front end 330, which would normally be exposed to oncoming waves, but in the present embodiment, the wave spreading structure 325 is positioned forwardly of portion 330 and deflects any waves away from the portion 330, similar to the wave spreading structures described in prior embodiments. This results in the hull portion 330 being recessed or internal to the wave contacting surfaces of the hull 350. The wave spreading structure 325 may be formed of sheet material, configured into a wedge shape having first and second sides 332 and 334 and the front edge 336 directed forwardly. The sides 332 and 334 of the wedge shape present substantially vertical surfaces to facilitate water displacement, resulting in a configuration that cuts through any waves, minimizing wave forces acting on the hull 350, and particularly hull portion 324. This also results in the hull 350 remaining substantially level as it moves across the water, even if waves or wave are encountered. Further, the hull 350 remains substantially level at different speeds when on plane, even if loaded. The sides 332 and 334 extend toward the rear of craft 10, forming a cavity behind the front edge 336. Toward the rear portion of the wave spreading structure 325, the sides 332 and 334 taper upward toward the rear, as shown in FIG. 9. The sides 332 and 334 may extend to a position which is adjacent the position that water contacts the internal prow formed by the front portion 330 allowing access to the front apex 390 and front portion 330. The wave slicing structures 355 extend from the front portion of the flat bottom portions 328 and 340. The wave slicing structures 355 may be configured similarly to that described in the embodiment of FIGS. 6 and 7 for example. The two sides of the wave slicing structures 355 are substantially vertical at the front edges 326 and 336 and transition to a substantially horizontal position adjacent the flat bottoms 328 and 340. If desired, the rear of the sides of the wave slicing structures 355 may be cut at an angle as shown, forming another triangular shape at the rear of the wave slicing structures 355. The wave slicing structures 355 generate a vortex in the water that forces water to the bottom and outside edges of hull portions 322 and 324. The water is then forced by gravity back into the water and not into the boat’s cockpit. This slicing structure may be termed a wave diffusion system. Further, splash guards 371 may be provided to extend outwardly from the front portion of the outer hulls 322. The splash guards 371 extend rearwardly from the front, and may be above the surface of the water. Each splash guard 371 blocks any water that is forced upward due to the interaction between the hull portions 322 and the water.

[0044] Each hull portion 322 is also formed with a substantially vertical front edge profile, presenting the approaching water with a knife-edge-like profile. This edge cuts through any waves or wake and displaces water laterally of each hull portion 322 along with the wave spreader like structure 325 associated with center hull 324. From the front edges 326, the hull portions 322 are formed to have substantially flat bottoms 340, to facilitate water displacement and planning of the boat during operation. Also, from the front edge 336, the hull portion 324 is formed to have a substantially flat bottom 328, to facilitate water displacement and planning of the boat during operation.

[0045] The front edge 326 and forward side sections 329 of the hull portions 322 form v-shaped or wedge shaped portions which present somewhat vertically oriented wave spreading surfaces. Each hull portion 322 acts to spread waves laterally of the boat, and into the spaces 323 between hull sections. The spaces 323 between hulls 322 and 324 are designed to accommodate the volume of water displaced by the hulls based upon the size of the boat.

[0046] The wave spreading hull portions 322 may extend to a position that is spaced rearwardly from the front of center hull 324, such that oncoming wave are first contacted by center hull 324, and subsequently contacted by the hulls 322. The hulls 322 and wave spreading portion 325 associated with hull portion 324 are configured to cut through and deflect waves with minimal resistance. The hull portions 322 and wave spreading section 325 are designed such that the forward sections are positioned just above the smooth water level when the craft is in operation, such that smooth water will not impose substantial forces on the hull portions 322 and wave spreading section 325. Oncoming waves are spread and directed immediately away from the hull portions 322 and wave spreading section 325 by the substantially vertically oriented wedge surfaces 332 and 334 of hull portion 324, and the surfaces 329 of hull portions 322, which cut through and deflect water with less drag than other hull configurations. The height of the apex 326 of hull portions 322 and 336 of wave spreading portion 325 may be suitable for the environment in which the watercraft is to be used, and generally are designed to extend out of flat water to a height above any expected waves based on the size of boat and type of water bodies the boat would be operated in. For example, for watercraft adapted for use in large bodies of water with larger waves, the vertical height of the forward sections may have a greater height.

[0047] Since the wave spreading configuration of each hull portion 322 and 324 is designed to deflect oncoming waves substantially horizontally, the wave-contacting surfaces are preferably substantially perpendicular to the smooth water surface while the watercraft is at cruising speed. However, it is also contemplated that the wave-contacting surface planes may be scooped or at a slight acute or obtuse angle to the smooth water while the watercraft is at cruising speed. For example, a slight obtuse angle between the plane of smooth water and the wave-contacting surface planes of the hull
portions 322 and wave spreader structure 325 will tend to deflect oncoming waves and therefore increasingly drive the watercraft through the waves.

[0048] Referring again to FIG. 8, and the hull portion 324, it should be recognized that there is an air cavity 338 located rearwardly of the wave spreader structure 325. The air cavity 338 extends from the wave spreader 325 to the internal hull prow 330. Internal hull prow 330 comprises the forward end of the hull bottom, and extends into the substantially flat-bottomed section 328. In this embodiment, internal hull prow 330 is located at approximately sixty percent (60%) of the length of hull 350 as measured from the stern 14, but lengths between approximately 50 to 90% are contemplated. The location of internal hull prow 330, can vary further for different applications or environments within the scope of the present embodiment. Due to the wave spreading action of the hulls 322 and wave spreader structure 325, generally, internal hull prow 330 encounters mostly smooth water.

[0049] Conventional flat-bottomed watercraft have a tendency to pitch and roll upon encountering waves. With the present invention, this problem is greatly reduced by the wave spreading hull portions 322 and structure 325. As the surfaces 334 and 336 spread or deflect oncoming waves substantially horizontally away from the hull 350, waves which would tend to cause a flat bottomed hull to pitch up are significantly reduced.

[0050] The hull bottoms 328 and 340 generally provide a large flat surface transitioning from the forward wave-deflecting surfaces, such that the hull displaces less water than conventional v-bottomed hulls at cruising speed. The smaller displacement of water enables the watercraft to cruise higher in the water, as compared to conventional v-bottomed watercrafts. Additionally, the watercraft leaves a smaller wake and requires less power for propulsion. Therefore, fuel economy is increased as compared to conventional v-bottomed boat hulls. Further, at the stern 16 of the craft 10, the bottoms 340 of the outer hulls 322 may extend to a position rearward of the rear wall or motor mount adjacent the rear of center hull section 324, to extend the flat bottom surface which ride on the water during operation. The center hull 324 may be configured such that the bottom surface 328 terminates at a position forward of the outer hulls 322. Water deflected by the wave deflecting surfaces of hulls 322 and 324, is thereby channeled through the spaces 323 between hulls, and at the stern, only the outer hulls have bottom surfaces contacting the water, to provide a relief zone between hulls 322 at the rear of the hull 350.

[0051] Turning to FIGS. 10 and 11, an alternate embodiment of the hull configuration is shown at 400, with outer hull portions 402 and 404 and center hull portion 406, each having a wave slicing structure 410 similar to that described in FIGS. 8 and 9 associated therewith. In this embodiment, the outer hulls 402 and 404, as well as the center hull portion 406 each have a pointed V-shaped front-end comprising a wedge-shaped structure forming a forward apex and two side walls extending rearwardly from the apex. If desired, the center hull portion 406 may not be provided, with just the outer hull portions 402 and 404 provided. In this embodiment, the central hull 406 does not have a separated wave spreading structure associated therewith, but still may itself extend forwardly of the outer hulls 402 and 404. The extent that the central hull 406 extends forwardly of the outer hulls 402 and 404 can vary depending on the size of the watercraft 400, and the type of water body the craft is designed to operate in. In general, the central hull 406 length may be from between 5 to 25% greater than the outer hull lengths. Each of the hull portions 402, 404 and 406 are configured to have a substantially flat bottom portion 412, with the substantially flat bottom portion 412 beginning at the front edge of each hull portion and extending rearwardly to the rear of hull portions. The wedge shaped structure of each of the hull portions 402, 404 and 406 cuts through and deflects any waves away from the hull portions to the outside of the outer hull portions and spaces between hull portions, similar to the wave spreading structures described in prior embodiments. The sides of the wedge shaped structures of each hull portion present substantially vertical surfaces to facilitate water displacement, resulting in a configuration that cuts through any waves, minimizing wave forces acting on the hull portions. This also results in the hull 400 remaining substantially level as it moves across the water, even if waves or wake are encountered. Further, the hull 400 remains substantially level at different speeds when on plane, even if loaded. The wave slicing structures 410 extend from the front portion of the flat bottom portions 412. The wave slicing structures 410 may be configured similarly to that described in the prior embodiments for example. The two sides of the wave slicing structures 410 are substantially vertical at the front edges and transition to a substantially horizontal position adjacent the flat bottoms 412. The wave slicing structures 410 again generate a vortex in the water that forces water to the bottom and outside edges of hull portions 402, 404 and 406. This slicing structure may be termed a wave diffusion system. In this embodiment, the ski portions 412 are configured to match the shape of the front portion of each hull portion, and no splash guards are utilized, but the arrangement of the prior embodiments could also be used.

[0052] Thus, in this embodiment, each hull portion 402, 404 and 406 is formed with a substantially vertical front edge profile, presenting the approaching water/waves with a knife-edge type of profile. This edge cuts through any waves or wake and displaces water laterally of each hull portion. From the front edges, the hull portions 402, 404 and 406 are formed to have substantially flat bottoms 412, to facilitate water displacement and planing of the boat during operation. The front edge and forward side sections of the hull portions 402, 404 and 406 form V-shaped or wedge shaped portions which present somewhat vertically oriented wave spreading surfaces. Each hull portion acts to spread waves laterally of the boat, and into the spaces between hull sections. The spaces between hulls 402, 404 and 406 are designed to accommodate the volume of water displaced by the hulls based upon the size of the boat and expected wave sizes.

[0053] The outer wave spreading hull portions 402 and 404 may extend to a position that is spaced rearwardly from the front of center hull 406, such that oncoming waves are first contacted by center hull 406, and displaced toward the spaces between outer hulls 402 and 404 subsequently contacted by the hulls 402 and 404. The hull portions are configured to cut through and deflect waves with minimal resistance. The hull portions are designed such that the forward sections are positioned just above the smooth water level when the craft is in operation, such that smooth water will not impose substantial forces on the hull portions. Oncoming waves are spread and directed immediately away from the hull portions by the substantially vertically oriented wedge surfaces of each hull portion, which cut through and deflect water with less drag than other hull configurations. The height of the apex of each hull portion may be suitable for the environment in which the
watercraft is to be used, and generally are designed to extend out of flat water to a height above any expected waves based on the size of boat and type of water bodies the boat would be operated in. For example, for watercraft adapted for use in larger bodies of water with larger waves, the vertical height of the forward sections may have a greater height.

[0054] Since the wave spreading configuration of each hull portion is designed to deflect oncoming waves substantially horizontally, the wave-contacting surfaces are preferably substantially perpendicular to the smooth water surface while the watercraft is at cruising speed. However, it is also contemplated that the wave-contacting surface planes may be scooped or at a slight acute or obtuse angle to the smooth water while the watercraft is at cruising speed. For example, a slight obtuse angle between the plane of smooth water and the wave-contacting surface planes of the hull portions will tend to deflect oncoming waves and therefore increasingly drive the watercraft through the waves.

[0055] As with the other embodiments, the problems associated with conventional flat-bottomed watercraft which have a tendency to pitch and roll upon encountering waves, are resolved. As the wedge-shaped structures of each hull portion spread or deflect oncoming waves substantially horizontally away from the hull 400, which would tend to cause a flat bottomed hull to pitch up are significantly reduced.

[0056] The hull bottoms 412 generally provide a large flat surface transitioning from the forward wave-deflecting surfaces, such that the hull displaces less water than conventional v-bottomed hulls at cruising speed. The smaller displacement of water enables the watercraft to cruise higher in the water, as compared to conventional v-bottomed watercrafts. Additionally, the watercraft leaves a smaller wake and requires less power for propulsion. Therefore, fuel economy is increased as compared to conventional v-bottomed boat hulls.

[0057] The foregoing disclosure is illustrative of embodiments of the present invention and is not to be construed as limiting thereof. Although one or more embodiments of the invention have been described, persons of ordinary skill in the art will readily appreciate that numerous modifications could be made without departing from the scope and spirit of the disclosed invention. As such, it should be understood that all such modifications are intended to be included within the scope of this invention. The written description and drawings illustrate the present invention and are not to be construed as limited to the specific embodiments disclosed.

What is claimed is:
1. A watercraft comprising:
   a hull having a bow, a stern, a port side, and a starboard side,
   the hull having two outer hull portions and a center hull portion,
   having a volume of space therebetween, wherein each hull portion is formed with a bottommost portion formed as a substantially flat ski type surface,
   the outer and center hull portions having a front portion comprising a wedge shaped structure forming a forward apex and two side walls extending rearwardly from the apex; and
   wherein waves impinging upon the front portion of each hull portion are spread laterally away from the watercraft and into the volume of space between the outer hull portions; and
   wherein the volume of space is at least as great as the volume of laterally spread waves.

2. The watercraft as recited in claim 1, further comprising wave slicing structures extending from a bottom of the front portion of said substantially flat ski type surface of the hull portions, said wave slicing structure comprising a substantially triangular shaped structure having a forward apex and two transitioning side walls extending rearwardly from the apex comprise a leading edge substantially perpendicular to said substantially flat ski surface with the sides transitioning to a substantially horizontal position adjacent to said substantially flat ski type surface.

3. The watercraft as recited in claim 1, wherein the separate wave spreading structure is formed as a wedge shaped structure having a front apex and side walls extending rearwardly from the apex.

4. The watercraft as recited in claim 1, wherein the hull portions each have a substantially flat ski type bottom surface that extends to the front of the hull portion.

5. The watercraft as recited in claim 1, further comprising a wave slicing structure extending from a front portion of the substantially flat ski type bottom surface of each hull portion.

6. The watercraft as recited in claim 1, wherein the wave slicing structure associated with each hull portion comprises a substantially triangular shaped structure having a forward apex and two transitioning side walls extending rearwardly from the apex, wherein said wave slicing structure generates a vortex with a water surface.

7. The watercraft as recited in claim 1, wherein the center hull portion has a length which is approximately 5 to 25% greater than the outer hull lengths.

8. The watercraft as recited in claim 1, wherein the volume of laterally spread waves is channeled through the volume of space between the hull portions, the volume of space providing a relief zone between hull portions at the stern of the watercraft.

9. A watercraft comprising:
   a hull having a bow, a stern, a port side, and a starboard side
   the hull having two outer hull portions and a center hull portion positioned between the outer hull portions, the hull further having a volume of space between each of the two outer hull portions and the center hull portion,
   wherein the hull portions are formed with a bottommost portion formed as a substantially flat ski type surface,
   and having a wave spreading structure including a front portion comprising a wedge shaped structure from a forward apex and two side walls extending rearwardly from the apex; and
   wave slicing structures extending from a bottom of the front portion of said substantially flat ski type surface of the hull portions, said wave slicing structures comprising a substantially triangular shaped structure having a forward apex and two transitioning side walls extending rearwardly from the apex.

10. The watercraft as recited in claim 9, wherein the wave slicing structure associated with each hull portion generates a vortex with a water surface.

11. The watercraft as recited in claim 10, wherein the center hull portion has a length which is approximately 5 to 25% greater than the outer hull lengths.

12. The watercraft as recited in claim 9, wherein the center hull portion includes a separate wave spreading structure with an internal prow spaced from the wave spreading structure, the internal prow positioned at approximately 50 to 90% of the length of the hull extending from the stern.

13. The watercraft as recited in claim 12, wherein the wave spreading structure associated with the center hull portion forms a cavity in front of the internal prow.
14. The watercraft as recited in claim 9, wherein the volume of waves impinging upon the front portion of the outer hull portions is spread laterally away from the watercraft and into the volumes of space between the outer hull portions and the center hull portion and the volume of waves impinging upon the front portion of the center hull portion is spread approximately equally into each of the volumes of spaces; wherein the volumes of space are at least as great as the volume of laterally spread waves.

15. A monolithic watercraft hull comprising a hull having a bow, a stern, a port side, a starboard side, and a bottom; with at least two outer hull portions at the port and starboard sides, the at least two outer hull portions having a substantially flat ski type bottommost surface, and a wave spreading structure disposed at the forward ends, the wave spreading structure comprising a wedge shaped structure having a forward apex and two side walls extending rearwardly from the apex, wherein the side walls are positioned with a lower edge disposed just above the smooth water level when the craft is in operation, and the forward apex being a substantially vertically oriented wedge surface with the height of the forward apex extending out of flat water to a height above any expected waves so as to deflect oncoming waves away from the wave spreading structures and the hull portions disposed rearwardly thereof.

16. The watercraft hull as recited in claim 15, further comprising at least one center hull portion having a substantially flat ski type bottommost surface, and a wave spreading structure positioned at the forward end.

17. The watercraft hull as recited in claim 15, wherein the center hull portion includes a separate wave spreading structure with an air space is formed between the wave spreading structure and the front surface of the hull portion intermediate the bow and stern.

18. The watercraft hull as recited in claim 15, wherein the wave spreading structure of the center hull portion extends forwardly of the wave spreading structure of the outer hull portions.

19. The watercraft hull as recited in claim 15, further comprising wave slicing structures extending from the bottom of the front portion of said substantially flat ski type surface of each hull portion.

20. The watercraft hull as recited in claim 19, wherein the wave slicing structures comprise a leading edge substantially perpendicular to said flat ski type surface with sides that transition to a substantially horizontal position adjacent to said substantially flat ski type surface.

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