May 31, 1966 R. A. PATTON, JR 3,253,567

MECHANISM FOR USE IN CONJUNCTION WITH THE INTAKE OPENING OF A WATER JET PROPELLED VEHICLE

Filed Sept. 4, 1963 5 Sheets-Sheet 1

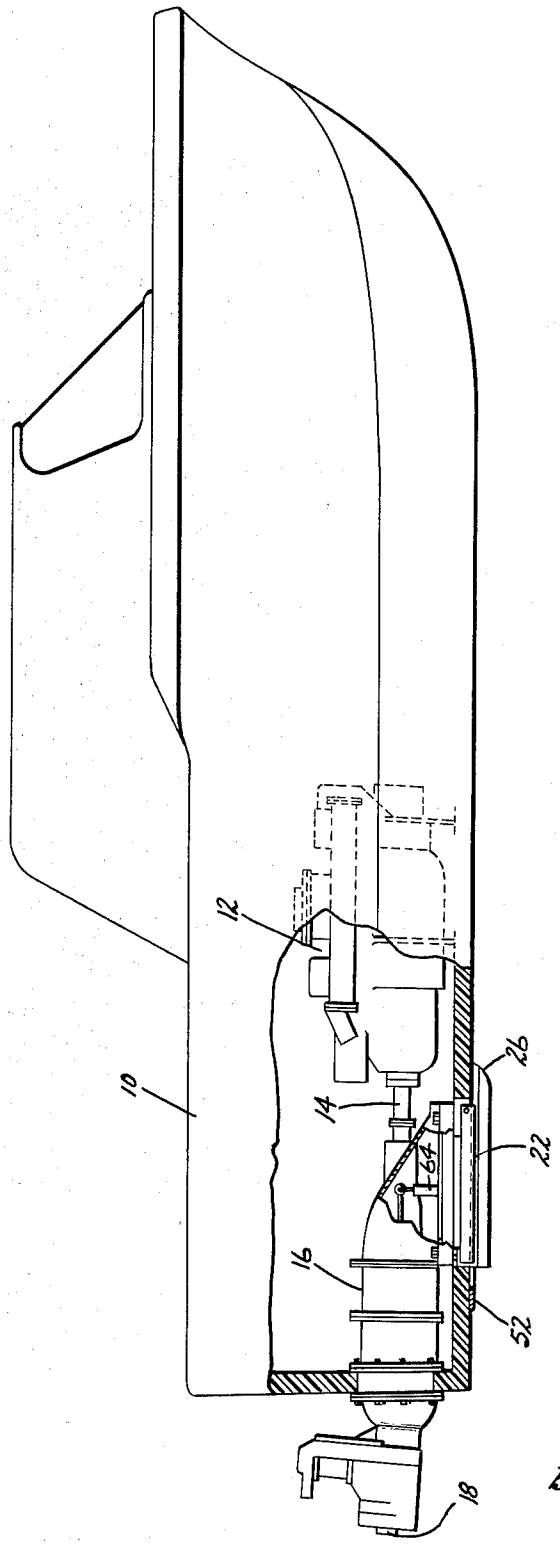


Fig. 1.

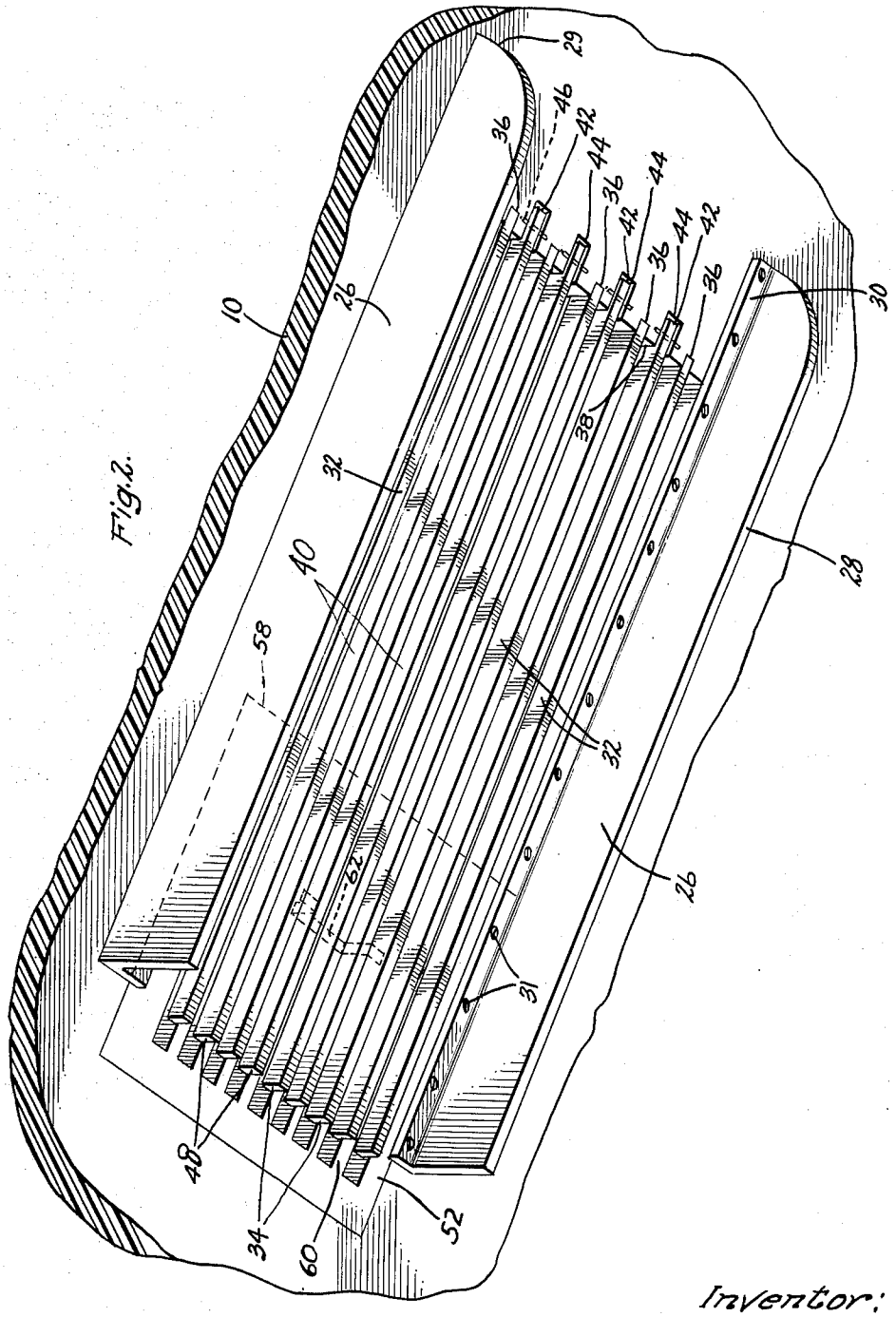
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MECHANISM FOR USE IN CONJUNCTION WITH THE INTAKE OPENING OF A WATER JET PROPELLED VEHICLE

Filed Sept. 4, 1963 5 Sheets-Sheet 2

Fig. 2.



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MECHANISM FOR USE IN CONJUNCTION WITH THE INTAKE OPENING OF A WATER JET PROPELLED VEHICLE

Filed Sept. 4, 1963 5 Sheets-Sheet 3

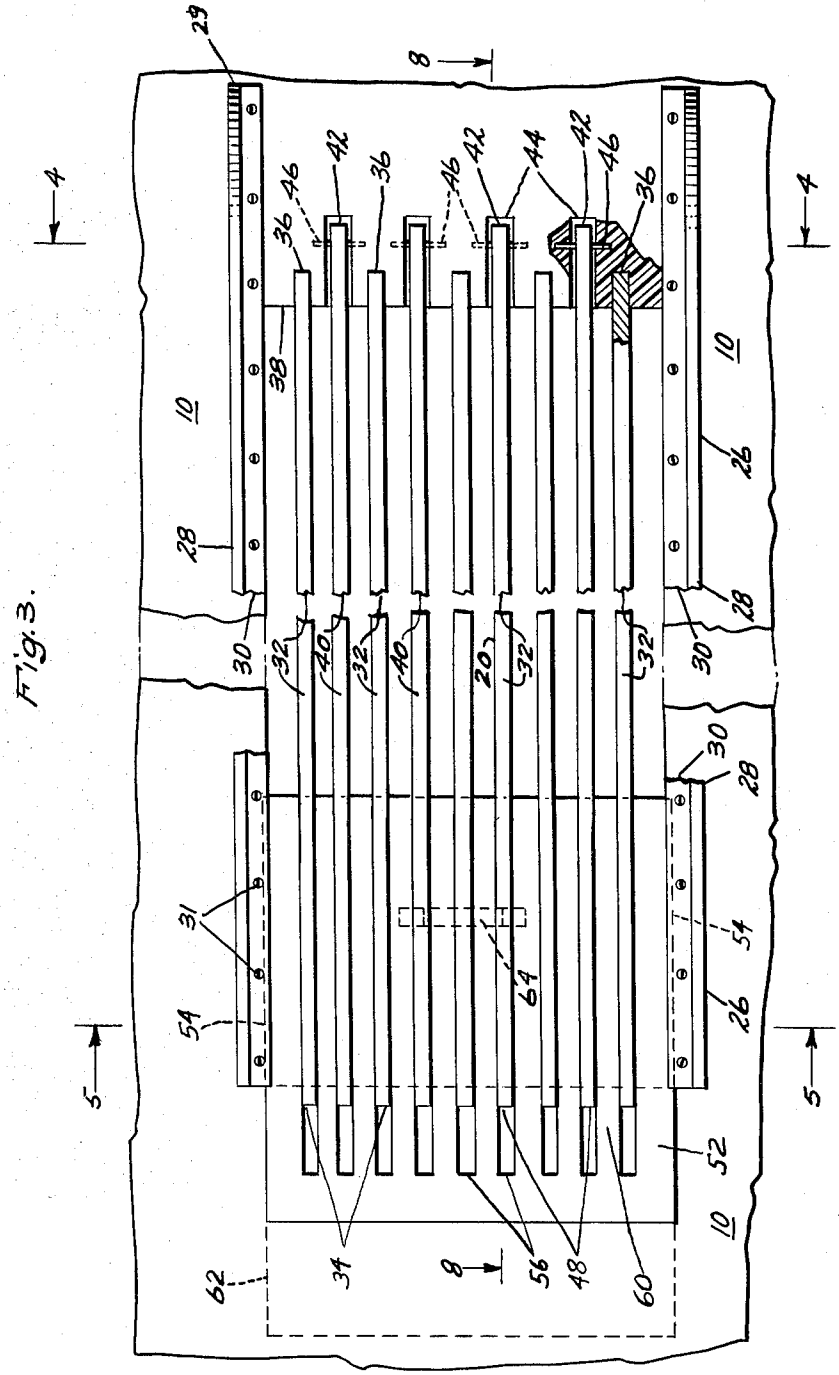


Fig. 3.

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MECHANISM FOR USE IN CONJUNCTION WITH THE INTAKE OPENING OF A WATER JET PROPELLED VEHICLE

Filed Sept. 4, 1963 5 Sheets-Sheet 4

Fig. 4

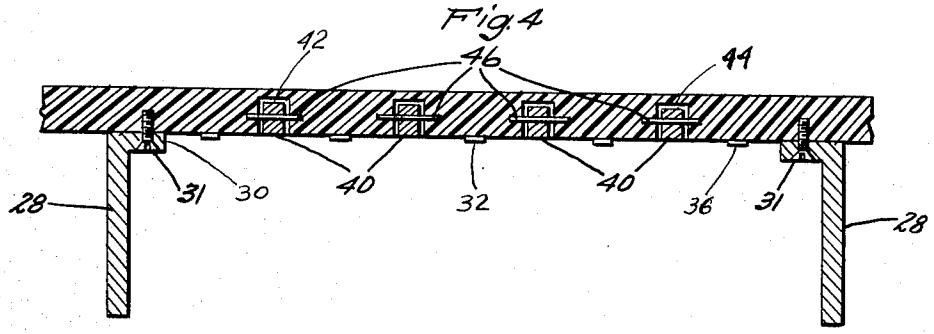
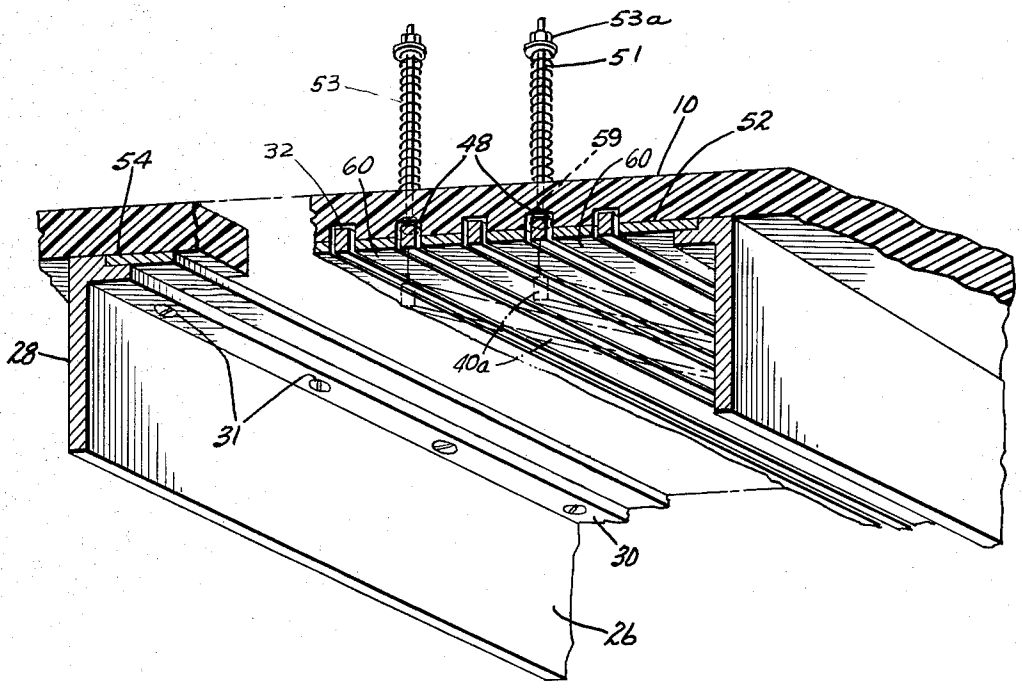


Fig. 5.



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May 31, 1966 R. A. PATTON, JR 3,253,567

MECHANISM FOR USE IN CONJUNCTION WITH THE INTAKE OPENING OF A WATER JET PROPELLED VEHICLE

Filed Sept. 4, 1963 5 Sheets-Sheet 5

Fig. 6.

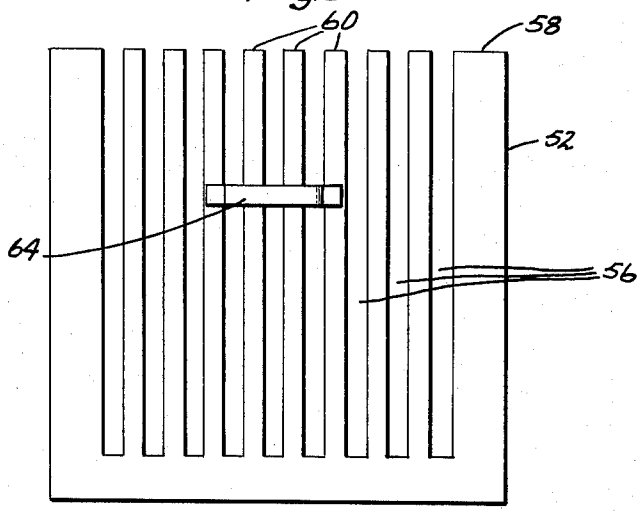


Fig. 9.

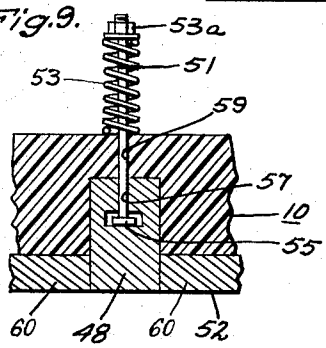


Fig. 7

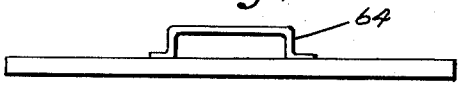
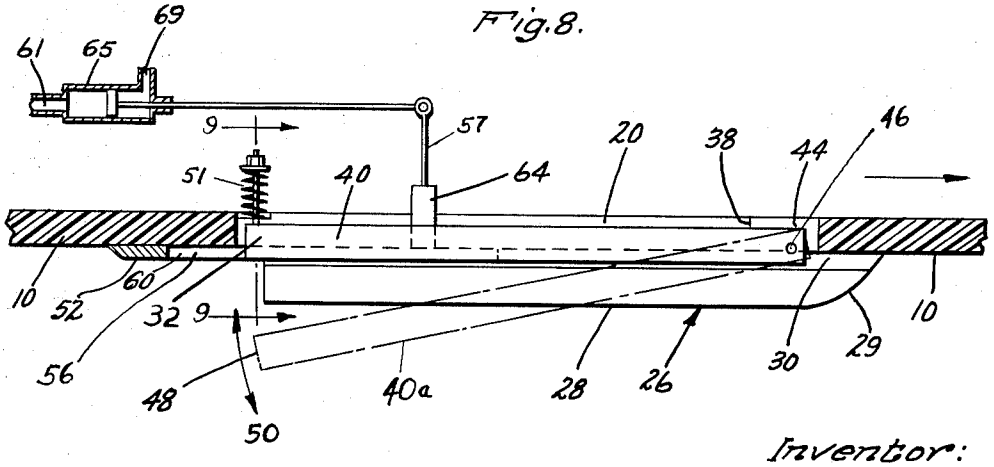


Fig. 8.



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3,253,567

MECHANISM FOR USE IN CONJUNCTION WITH THE INTAKE OPENING OF A WATER JET PROPELLED VEHICLE

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Filed Sept. 4, 1963, Ser. No. 306,521
14 Claims. (Cl. 115—.5)

This invention relates generally to mechanism for use in conjunction with the intake opening of a water jet propelled vehicle, and more specifically to mechanism for improving the operation of water intake in such a vehicle.

One type of jet propelled vehicle is a boat provided with an engine driven pump which draws water through an intake opening located in the bottom of the boat, imparts a high velocity to the water, and discharges the water from the rear of the boat. This high velocity discharge of water from the rear of the boat provides the boat's locomotion. The water drawn through the intake opening passes into the pump with sufficient velocity to suspend small objects, weeds and other debris in its stream, and thereby carry them into the pump, causing impairment of pump operation and possibly pump damage.

This difficulty has been reduced to a certain extent by locating the intake opening in the bottom of the boat generally parallel with the direction of flow of water adjacent the hull. Therefore, debris must be sucked into the opening rather than merely impinging on the opening in order to reach the pump. Devices have also been proposed for straining the fluid before it passes into the intake opening, but these have not completely solved this problem. Those strainers that are effectual soon become clogged with weeds or debris and thereby restrict the flow of liquid into the pump; this restricted flow can greatly reduce the maximum speed or acceleration of the boat. Other straining devices are not easily clogged with weeds and debris but are ineffectual in protecting the pump.

Another difficulty with prior strainers and intake openings is that they are not adjustable. Efficient jet boat operation depends upon the availability and the delivery of water at the pump's capacity at all times and under all phases of boat operation. Jet boats heretofore have been designed with an intake opening of a size that insures efficient operation only under a small range of operating conditions. When the boat is standing still, just prior to acceleration, or is moving slowly, the opening is sufficient if it is large enough to permit the pump's fluid capacity to flow therethrough. As the boat picks up speed, the relative velocity of the water aids in the delivery of water to the pump as long as the flow remains generally laminar. As soon as turbulence develops, the fluid will vortex, froth, or in other ways develop air pockets in the water entering the intake opening and thereby present to the pump a mixture of air and water rather than water alone. Such a mixture in flowing through the pump may have deleterious effects on the pump and will cause a loss of thrust. It is therefore desirable under some conditions to have a somewhat larger intake opening than that theroetically efficient for slow speeds so that an increased volume of mixture may be presented to the pump, thereby regaining a part of the water volume lost. At highly turbulent planing speeds, the relative velocity of the fluid impinging on the intake opening aids in the compression of the water-air mixture by the pump resulting in a gain in efficiency. Opposing this gain in efficiency is a drag and a corresponding loss of power caused by the compression of the air-water mixture. It is therefore desirable to compress only that amount of mixture that will result in the proper amount of water being fed to the pump. This calls for a reduction of the size of the intake opening, possibly beyond the size used for slow speeds. Heretofore, there has been no known device which can remedy this problem by

adjusting the size of the intake opening. A further difficulty with prior strainers and intake openings becomes apparent when the boat heels over while turning corners and the intake opening or a part thereof comes out of the water. As soon as any part of the intake opening is not covered by water, air will be sucked into the pump, causing a great loss of power.

Although the above discussion of the prior art has concerned a jet propelled boat, it is equally applicable to other marine or amphibious vehicles such as amphibious tanks and cargo carriers, hydrofoil ships, and other liquid jet propelled vehicles.

It is accordingly an object of this invention to provide a strainer for use with a liquid jet propelled vehicle that is easily cleaned.

It is another object of this invention to provide mechanism for selectively varying the size of an intake opening of a liquid jet propelled vehicle.

It is another object of this invention to provide mechanism which minimizes the tendency of the intake drawing air upon a liquid jet propelled vehicle heeling over in a turn.

It is a further object of this invention to provide a strainer and an intake opening combination which is easily cleaned, is selectively variable in size, and does not draw air under normal operating circumstances.

It is a further object of this invention to provide a strainer and an intake opening combination, as mentioned above, that will insure the most efficient jet pump operation under all conditions and in all phases of vehicle operation.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a longitudinal cross-sectional view of a liquid jet propelled boat embodying the present invention;

FIG. 2 is a fragmentary isometric view of the bottom of the hull of a liquid jet propelled boat showing the present invention;

FIG. 3 is a fragmentary bottom view of the structure shown in FIG. 2;

FIG. 4 is a fragmentary sectional view taken substantially along section line 4—4 of FIG. 3;

FIG. 5 is a fragmentary, isometric sectional view taken substantially along section line 5—5 of FIG. 3;

FIG. 6 is a top view of the slidably attached closure plate;

FIG. 7 is a trailing end view of the closure plate of FIG. 6;

FIG. 8 is a fragmentary sectional view taken substantially along section line 8—8 of FIG. 3; and

FIG. 9 is a fragmentary illustration, partially in cross-section, taken substantially along section line 9—9 of FIG. 8.

Referring to the figures of the drawings, a liquid, jet propelled boat is shown, as an example and in no way limiting, having a hull **10**, a conventional marine engine **12** mounted generally centrally and operatively connected by a shaft **14** to a pump **16** having a discharge opening **18** at the rear of the boat. Located in the bottom of the hull **10** is an intake opening **20** (shown rectangular) which allows liquid to pass to the pump **16**. Covering the opening **20** is a strainer **22** to prevent weeds, small foreign objects and other debris from flowing into the pump **16**. Two laterally spaced and parallel sister keels or deflectors **26** are shown extending longitudinally with the hull adjacent the opposite longitudinal edges of opening **20** for at least the length of the latter.

Each deflector **26** is composed of an elongated flat or

keel portion **28** and a lateral mounting flange **30**, and is secured to the underside of the hull **10** by means of a suitable number of screws **31** which pass through the flange into the hull. Each keel portion **28** has its width depending perpendicularly from the bottom of the hull **10** with the length thereof being disposed adjacent to and parallel with the respective edge of the opening **20**. Also, the keel portion **28** has a length preferably longer than said opening **20**, and is positioned such that it extends for at least the entire length of the opening **20**. As shown in FIG. 3, the aft edges of the keel portions **28** are positioned flush with the aft end of the opening **20**, while the forward ends thereof extend forwardly of the opening **20**. Otherwise, the keel portions are positioned substantially parallel to the longitudinal axis of the hull **10**.

In a specific application, keel portions **28** may be slightly angularly disposed with respect to each other, the leading ends of portions **28** being farther apart than the trailing ends thereof. They also may be angularly disposed from the perpendicular or of various lengths relative to opening **20** as will become apparent from the following description. The leading ends **29** of portions **28** are curved to decrease drag and for increased safety of operation.

Parallel with the longitudinal edge of and spanning the opening **20** are a plurality of equally spaced and dimensioned elongated members or straining bars **32**, unattached at their trailing ends **34** and fixedly attached by means of adhesive, welding, etc., at their leading ends **36** to the hull at the leading edge **38** of opening **20**. Bars **32** are made of a material that is rigid, highly elastic and resilient, preferably stainless steel, so as to protect against corrosion and at the same time leave members **32** free to vibrate in the turbulent water flowing past. Members or bars **40** identically dimensioned and constructed as members **32**, excepting an added length to accommodate their means of attachment at their leading ends, are alternately positioned in spaced relation with members **32**; together they form a strainer or grate covering opening **20**.

The leading ends **42** of members **40** are positioned in recessed slots **44** in hull **10** which open through the edge **38**. Also, these ends **42** are pivotally connected to hull **10** by means of suitable pins **46** which extend perpendicularly to the longitudinal hull axis. Bars **32** are disposed at the outermost and central positions of the strainer.

Bars **40** lie between members **32**, having unattached trailing ends **48**, are capable of pivotal movement about the axes of respective elements **46**, in the direction of arrows **50**. Members **40**, the same as members **32**, vibrate in the turbulent waters flowing along the underside of the hull **10**. The amplitude of vibration, however, is larger than that of members **32** because of the less rigid mounting thereof. Besides this vibratory motion, bars **40** can be moved individually and selectively by means of pins **51** as shown in FIGS. 5, 8 and 9. Pins **51** are provided with heads **55** which fit into T-shaped slots **57** in the aft ends **48** of bars **40** and project upwardly through sealed apertures **59** in the hull **10**. Springs **53** are fitted over pins **51** and are compressed between the hull **10** and retaining nuts **53***a* on the pins. Therefore, when in normal position, pins **51** do not interfere with the vibratory movement of bars **40**. However, the depression of pins **51** will move members **40** outwardly away from hull **10** as shown by the dashed line bars **40***a* in FIGS. 5 and 8. At position **40***a*, the members **40** will either be relatively stationary or vibrate with less amplitude than in their normal positions.

Slidably inserted into inwardly facing and opposing grooves **54** in flanges **30** of keels **26** which form an elongated slot with hull **10** extending from the trailing edges of keels **26** parallel to the longitudinal distance of opening **20** is a closure plate **52** (see FIGS. 3, 5 and 8). Closure plate **52**, shown alone in FIGS. 6 and 7, has a plurality of parallel slots **56** extending through plate **52**, equal in number to the cumulative total of members **32** and **40** but slightly wider than the dimensions thereof, and opening through plate edge **58**. Bars **32** and **40** lie within the slots **56** and juxtaposed with the tines **60** of forked plate **52**, thereby closing a portion of opening **20**. Closure plate **52** can be selectively positioned to cover a portion of opening **20** as desired for efficient operation of the boat (exemplified by position shown and position **62**) by means of a handle shaped appendage **64** which extends beyond the inside bottom surface of hull **10**. This handle **64** may be operated manually or by means of a lever or toggle system actuated hydraulically, electrically or by some similar means. As shown in FIG. 8, a two-way hydraulic power cylinder **65** is shown operatively connected to a rod **57** which is secured directly to the handle **64**. The power cylinder is operated selectively by means not shown whereby the plate **52** can be moved forwardly and rearwardly to desired positions and held in such positions by means of closed valves (not shown) in hydraulic lines connected to the two ports **69** and **61** of the cylinder **65**. By alternatively applying pressurized liquid to the two ports, this forward and reverse movement is achieved.

In a specific embodiment of this invention, intake opening **20** is twenty-four (24) inches long and fourteen (14) inches wide; each deflector **26** is about thirty (30) inches long; members **32** are about twenty-two (22) inches long; members **40** are about twenty-six (26) inches long; and closure plate **52** is about sixteen (16) inches square having slots **56** that are about thirteen (13) inches long. A typical depth dimension for the deflectors **26** is three (3) inches.

In operation, water is drawn through the intake opening **20** into the pump **16** wherein velocity is imparted to the water by means of the engine **12** and the water is thrust through opening **18** at the rear of the hull, forcing the hull forward in the water. As the hull is traveling on a straight course through the water at a constant rate of speed and in alignment with its motion, the size of the intake opening **20** for efficient boat operation remains constant and members **32** and **40** merely vibrate in their normal position due to the flow of turbulent water around them. This vibratory action will normally keep weeds, foreign matter and other debris from collecting on the strainer while the boat is moving.

If weeds, foreign matter or debris are already attached to the strainer **22** and are not removed by the vibratory movement of members **32** and **40** nor by the velocity of the water flowing therepast, the flow of water to the pump **16** is thereby restricted and closure plate **52** would have to be positioned closer to the aft end of the hull as an increased size of the opening **20** is needed for the most efficient boat operation. However, pins **51** may be depressed to lower members **40** away from hull **10** to position **40***a* or to any position therebetween and there vibrate naturally because of the water flow or artificially from an oscillatory motion imparted to pins **51**, until the strainer **22** is cleaned. For this purpose, members **40** can be moved either individually or in combination with each other; and with a momentary sacrifice of pump power, closure plate **52** can be slid towards the bow to help scrape off any debris, weeds or foreign matter clinging to either members **32** or **40**. When the strainer **22** is cleaned, closure plate **52** will need to be moved forward from the position it had when the strainer **22** was clogged so as to decrease the size of the intake opening **20**.

Turning the hull **10** while in motion results in bringing the deflectors **26** into operation. Since the usual pleasure boat will bank or heel in a turn, it is obvious that if this heel is material, the intake **20** can partially leave the water. If this happens, the pump will suck

air prejudicially to water and propulsion will be lost. However, by use of the deflectors **26**, the inherent sideways slippage of the boat due to centrifugal force will result in water being deflected upwardly by the then lower deflector **26** to cover the opening **20**. Also, the uppermost deflector **26** will deflect water downwardly, such that the two deflectors **26** act in concert to maintain a supply of water for the opening **20**. Different amounts of water can be deflected toward the opening **20** by varying the shape of the oppositely facing deflector surfaces, such as making them parabolic or otherwise curved in a plane perpendicular to the planar surfaces shown or flat surfaces angularly disposed with hull **10**. The deflection of water must be great enough to supply the pump requirements. As the angle of water toward opening **20** may be more direct during a straight run, the water velocity may be greater through the opening **20**, thereby allowing the use of a smaller opening **20** for the same amount of water flow therethrough. For this reason, plate **52** may have to be adjusted with any change in the angle from alignment with the direction of motion, to provide the most efficient boat operation.

It also is evident that with any change in the angle that the water impinges on opening **20** (as in planing), or in the relative velocity of the water flowing past the hull, the velocity of water flowing through opening **20** may change. As any water in excess of the pump's capacity impinging on the opening **20** will result in drag, a less efficient operation will result than if the same water impinged on the hull **10**. Therefore, all changes in boat velocity generally require a change in position of plate **52** to maintain efficient operation.

At high boat velocities, the water surrounding and flowing past the hull **10** is very turbulent. Vortexes, froth and other turbulent water formations cause the pump to inhale an air-water mixture rather than pure water, thereby resulting in a loss of power. At planing speeds, this problem is somewhat reduced as the water impinges more normally on hull **10**, causing compression of these turbulent water formations and a requisite increased water flow to the pump **16**. Further improvement can be had by slightly angularly positioning the deflectors **26** with respect to each other so as to form a slightly wider spacing at the forward ends thereof through which water will flow toward opening **20**, thereby aiding in the compression of the air pockets in the water entering the pump **16**. Such an angular arrangement, however, must be tailored to the specific hull shape and only used where the increased power resulting therefrom is sufficient to offset the increased drag caused thereby.

This invention in its broader aspects comprises an intake opening or port in the bottom of a jet propelled boat hull which leads through a conduit into the intake end of a pump powered by a conventional marine engine, a strainer covering the opening or port, a slidable plate for selectively varying the size of the intake opening, and at least two keels or deflectors extending longitudinally of the hull for the distance of the opening.

While the pump and the marine engine and the mounting thereof within the boat may be conventional, the remaining structure disclosed herein constitutes the invention. The size of the intake port will generally be larger than that found in prior boats for the reason that now adjustability has been designed into the port, whereas prior port sizes were chosen for optimum performance over the whole range of boat operation.

Further, the method of attachment of the individual members or rods of the strainer has been altered over any known device to improve the self-cleaning ability of the strainer and to insure the removal of weeds and the like, therefrom.

Still further, at least two relatively large keels, extending the distance of the intake opening, serve to deflect water toward the opening when the boat is heeling over in a turn to insure the availability of water to the pump at all times and to likewise exclude air from passing into the pump.

Each of these features, enumerated here singularly, combine in the functioning thereof to provide efficient jet boat operation under all operating circumstances. The slidable plate, used to adjust the size of the intake opening, is necessary to compensate for the enlarged intake opening during the strainer cleaning process in which the elongated members of the strainer will be selectively moved further apart from each other, thereby increasing the area of the opening. Adjustment is also necessary when the boat is angularly disposed to its motion and the keels or deflectors are deflecting the water toward the opening, as the reuslt may be higher water velocities through the opening than when the boat is aligned with its motion. Still further, the opening must be adjusted as the boat goes into and out of planing velocities as planing may result in a more direct, hence forceful, flow of water into the intake opening as well as an increase in water velocity through the opening.

The present invention installed on hulls of other marine or amphibious vehicles or on structure other than the hull protruding into the water and operating as an intake for a liquid jet turbine will have similar operational problems, similar structure will be needed to overcome such problems and such vehicles will operate similarly to the liquid jet boat as described. For example, an amphibious vehicle to be used on land, swampy terrain and inland lakes will have more serious clogging problems due to vegetation clinging to the intake port, but will not operate at as high velocities as the jet boat described, nor will such vehicle heel over to expose its intake port to the air. On the other hand, a hydrofoil ship will have less vegetation clogging problems, but will have higher velocities, a greater planing angle, and possibly more difficulty on turning in exposing its intake port to the air. While this invention pertains to intake ports generally for use in conjunction with liquid jet propulsion systems, each marine or amphibious vehicle having such a system will have its own peculiar operational requirements and as is apparent from the preceding description, this invention supplies those requirements.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention.

What is claimed is:

1. In combination, a member having a longitudinal axis and a submergible intake port, a plurality of elongated parallel and spaced apart members having leading and aft ends, respectively, covering said port, said elongated members extending longitudinally of said member, alternate elongated members being pivotally connected to said member at the leading ends thereof for swinging movement toward and away from said member, the remaining alternate elongated members being fixedly connected to said member at the leading ends thereof, means for selectively pivoting the first-mentioned alternate elongated members toward and away from said member, means for deflecting water into said port in response to motion of said member in a direction at an angle with respect to said longitudinal axis, a closure plate slidably attached to said member, and means including said plate for selectively controlling the flow of fluid into said intake port.

2. In combination, a boat hull having an intake port in the bottom of said hull, said port having forward and aft ends; a strainer for covering said port, said strainer comprising a plurality of elongated members having leading and trailing ends, said members being spaced apart and parallel, said members extending longitudinally of said hull, the leading ends of first ones of said members being fixedly attached to said hull adjacent to the forward end

of said port, the leading ends of second ones of said members being pivotally attached to said hull adjacent to the forward end of said port for swinging movement about axes extending transversely of said hull, said first and second members being arranged alternately; two elongated keels depending from the bottom of said hull and extending longitudinally of said hull for the distance of and along opposite sides, respectively, of said port for deflecting fluid into said port in response to the motion of said boat hull angularly with respect to said deflectors; and a closure plate having forward and aft edges, said plate being slidably attached to said hull in a position partially to cover said port, said plate having a plurality of slots opening through the forward edge thereof which receives said elongated members, respectively; and means for selectively moving said plate with respect to said hull for varying the area of said port thereby controlling the flow of fluid into said port.

3. In combination, a boat hull having an intake port in the bottom of said hull, said port having forward and aft ends; a strainer for covering said port, said strainer comprising a plurality of elongated members having leading and trailing ends, said members being spaced apart and parallel and extending longitudinally of said hull, the leading ends of the first ones of said members being fixedly attached to said hull adjacent the forward end of said port, the leading ends of second ones of said members being pivotally attached to said hull adjacent the forward end of said port for swinging movement about axes extending transversely of said hull, said first and second member being arranged alternatively; two elongated keels depending from the bottom of said hull and extending longitudinally of said hull for the distance of and along opposite sides, respectively, of said port for deflecting fluid into said port in response to the motion of said boat hull angularly with respect to said deflectors.

4. In combination, a boat hull having an intake port in the bottom of said hull, said port having forward and aft ends; a strainer covering said port, said strainer comprising a plurality of elongated members having leading and trailing ends, said members being spaced apart and parallel and extending longitudinally of said hull, the leading ends of first ones of said members being fixedly attached to said hull adjacent to the forward end of said port, the leading ends of second ones of said members being pivotally attached to said hull adjacent to the forward end of said port for swinging movement about axes extending transversely of said hull, said first and second member being arranged alternately; and a closure plate having opposite forward and aft edges, said plate being slidably attached to said hull in position partially to cover said port, said plate having a plurality of slots opening through the forward edge thereof which receive said elongated members, respectively, and means for selectively moving said plate with respect to said hull for varying the area of said port thereby controlling the flow of fluid into said port.

5. In combination, a boat hull having a longitudinal axis of symmetry and a bottom provided with inner and outer bottom surfaces; an intake port in said bottom having forward and aft ends and opposite lateral edges extending axially of said hull; a plurality of axially extending and equally spaced elongated members covering said port, said members having leading and trailing ends, said members being alternately fixedly and pivotally attached to said hull at said leading ends proximate to said forward end of said port, predetermined ones of said fixedly attached members being disposed adjacent to the center and lateral edges of said port, said fixedly attached members having elastic properties and being free to vibrate, all of said members being unattached at said trailing ends and overhanging said aft end forming a strainer overlying said port; a plurality of push rods connected to said pivotally attached members proximate to said trailing ends thereof, said push rods passing through said hull bottom whereby said pivotally attached members may be swung away from said outer bottom surface of said hull, means yieldably urging said pivotally attached members toward said port; two allochiral sister keels L shaped in cross-section having opposite ends, said keels comprising a mounting flange and a keel portion perpendicular thereto, said flanges being secured to said outer bottom surface on opposite sides, respectively, of said port, said keel portions extending longitudinally of said hull, said flanges extending laterally inwardly toward each other, said mounting flanges having inwardly facing grooves which extend longitudinally from the aft ends of said sister keels adjacent to said bottom surface; and a forked closure plate comprising a plurality of elongated parallel tines joined at one end thereof, said plate being slidably positioned in said grooves with said members and said tines in spaced juxtaposition whereby said plate may be slid back and forth on said outer bottom surface alternately to decrease and increase the area of said opening without impairing the movement of said vibratory and pivotal members, an actuating member fixedly attached at a central location to said plate whereby force may be applied to said actuating member to slide said plate.

6. In combination, a boat hull having a longitudinal axis and a bottom provided with an intake port, an engine mounted in said hull, a pump mounted in said hull and having inlet and exhaust ducts, said pump being operatively connected to said engine and said inlet duct being registered with said intake port, means including said exhaust duct for propelling said hull in response to operation of said engine and pump, said port having forward and aft edges extending transversely of said hull and opposite lateral edges extending longitudinally of said hull, a plurality of elongated, parallel and spaced apart members having leading and aft ends, respectively, covering said port, said members extending longitudinally of said hull, alternate members being pivotally connected to said hull at the leading ends thereof for at least swinging movement toward and away from said hull bottom, the remaining alternate members being fixedly connected to said hull at the leading ends thereof, means for selectively pivoting the first mentioned alternate members toward and away from said hull bottom, a plurality of push rods connected to said pivotally connected members, said push rods being mounted in said hull bottom for selective opposite rectilinear movement in directions which move said pivotally connected members toward and away from, respectively, said bottom, means for moving said push rods in a direction to move said pivotally connected members toward said bottom, two elongated spaced apart and parallel keel members mounted on and depending from said bottom, said keel members extending longitudinally of said hull on opposite sides, respectively, of said port, said keel members being adjacent to the respective lateral port edges, said keel members extending for the longitudinal distance of said port, groove means provided on opposite lateral sides of said port adjacent to the aft edge thereof, a flat plate mounted in said groove means for movement to a first position in which said port is partially covered and to a second position in which said port is less partially covered, said plate having a plurality of spaced apart parallel slots which movably receive the aft end portions of said elongated members, said slots having a length sufficient to permit movement of said plate between said first and second positions, and means for selectively moving said plate to a given position between said first and second positions.

7. In combination, a boat hull having a longitudinal axis and a bottom provided with an intake port, an engine mounted in said hull, a pump mounted in said hull and having inlet and exhaust ducts, said pump being operatively connected to said engine and said inlet duct being registered with said intake port, means including said exhaust duct for propelling said hull in response to operation of said engine and pump, said port having forward

and aft edges extending transversely of said hull and opposite lateral edges extending longitudinally of said hull, a plurality of elongated parallel and spaced apart members having leading and aft ends, respectively, covering said port, said members extending longitudinally of said hull, alternate members being pivotally connected to said hull at the leading ends thereof for swinging movement toward and away from said hull bottom, the remaining alternate members being fixedly connected to said hull at the leading ends thereof, means for selectively pivoting the first mentioned alternate members toward and away from said hull bottom, a plurality of push rods connected to said pivotally connected members, said push rods being mounted in said hull bottom for selective opposite rectilinear movement in directions which move said pivotally connected members toward and away from, respectively, said bottom, means for moving said push rods in a direction to move said pivotally connected members toward said bottom, two elongated spaced apart and parallel keel members mounted on and depending from said bottom, said keel members extending longitudinally of said hull on opposite sides, respectively, of said port, said keel members being adjacent to the respective lateral port edges, said keel members extending for the longitudinal distance of said port, groove means provided on opposite lateral sides of said port adjacent to the aft edge thereof.

3. In combination, a boat hull having a longitudinal axis and a bottom provided with an intake port, an engine mounted in said hull, a pump mounted in said hull and having inlet and exhaust ducts, said pump being operatively connected to said engine and said inlet duct being registered with said intake port, means including said exhaust duct for propelling said hull in response to operation of said engine and pump, said port having forward and aft edges extending transversely of said hull and opposite lateral edges extending longitudinally of said hull, two elongated spaced apart and parallel keel members mounted on and depending from said bottom, said keel members extending longitudinally of said hull on opposite sides, respectively, of said port, said keel members being adjacent to the respective ones of said lateral edges, said keel members extending for at least the longitudinal distance of said port and defining the opposite sides of an open space free of tangible structure that projects beneath said port, said space having an open forward end, an open aft end and an open bottom communicating with said space, each of said keel members being impervious to water and having a surface facing the other of said keel members, whereby water is deflected into said port in response to turning motion of said hull.

9. In combination, a boat hull having a longitudinal axis and a bottom provided with an intake port, an engine mounted in said hull, a pump mounted in said hull and having inlet and exhaust ducts, said pump being operatively connected to said engine and said inlet duct being registered with said intake port, means including said exhaust duct for propelling said hull in response to operation of said engine and pump, said port having forward and aft edges extending transversely of said hull and opposite lateral edges extending longitudinally of said hull, two elongated spaced apart and parallel keel members mounted on and depending from said bottom, said keel members extending longitudinally of said hull on opposite sides, respectively, of said port, said keel members being adjacent to the respective lateral port edges, said keel members extending for at least the longitudinal distance of said port and defining opposite sides of a space which extends beneath said port, groove means provided on opposite lateral sides of said port adjacent to the aft edge thereof, a flat plate mounted in said groove means for movement to a first position in which said port is partially covered and to a second position in which said port is less partially covered, and means for selectively moving said plate to a given position between said first and second positions.

10. In combination, a boat hull having a longitudinal axis and an intake port in the bottom thereof, a plurality of elongated parallel and spaced apart members having leading and aft ends, respectively, covering said port, said members extending longitudinally of said hull, alternate members being pivotally connected to said hull at the leading ends thereof for swinging movement toward and away from said hull bottom, the remaining alternate members being fixedly connected to said hull at the leading ends thereof, means for selectively pivoting the first-mentioned alternate members toward and away from said hull bottom.

11. In combination, a boat hull having a longitudinal axis and a bottom provided with an intake port, an engine mounted in said hull, a pump mounted in said hull and having inlet and exhaust ducts, said pump being operatively connected to said engine and said inlet duct being registered with said intake port, means including said exhaust duct for propelling said hull in response to operation of said engine and pump, said port having forward and aft edges extending transversely of said hull and opposite lateral edges extending longitudinally of said hull, two elongated keel members mounted on and depending from said bottom, said keel members extending longitudinally of said hull on opposite sides, respectively, of said port, said keel members being adjacent to the respective ones of said lateral edges, said keel members defining the opposite sides of an open space free of tangible structure that projects beneath said port, said space having an open forward end, an open aft end and an open bottom communicating with said space, each of said keel members being impervious to water and having a surface facing the other of said keel members, whereby water is deflected into said port in response to turning motion of said hull.

12. In combination, a boat hull having a longitudinal axis and a bottom provided with an intake port, an engine mounted in said hull, a pump mounted in said hull and having inlet and exhaust ducts, said pump being operatively connected to said engine and said inlet duct being registered with said intake port, means including said exhaust duct for propelling said hull in response to operation of said engine and pump, said port having forward and aft edges extending transversely of said hull and opposite lateral edges extending longitudinally of said hull, a plurality of elongated and spaced apart members having leading and aft ends, respectively, covering said port, said members extending longitudinally of said hull, a first portion of said members being pivotally connected to said hull at the leading ends thereof for swinging movement toward and away from said hull bottom, the remaining portion of said members being fixedly connected to said hull at the leading ends thereof, means for selectively pivoting said first portion of members toward and away from said hull bottom, a plurality of push rods connected to said pivotally connected members, said push rods being mounted in said hull bottom for selective opposite rectilinear movement in directions which move said pivotally connected members toward and away from, respectively, said bottom, means for moving said push rods in a direction to move said pivotally connected members toward said bottom.

13. In combination, a boat hull having a longitudinal axis and a bottom provided with an intake port, an engine mounted in said hull, a pump mounted in said hull and having inlet and exhaust ducts, said pump being operatively connected to said engine and said inlet duct being registered with said intake port, means including said exhaust duct for propelling said hull in response to operation of said engine and pump, said port having forward and aft edges extending transversely of said hull and opposite lateral edges extending longitudinally of said hull, a plurality of elongated and spaced apart members having leading and aft ends, respectively, covering said port, said members extending longitudinally of said hull, a first portion of said members being pivotally connected to said

hull at the leading ends thereof for swinging movement toward and away from said hull bottom, the remaining portion of said members being fixedly connected to said hull at the leading ends thereof, and means for selectively pivoting said first portion of members toward and away from said hull bottom.

14. In combination, a boat hull having a longitudinal axis and a bottom provided with an intake port, an engine mounted in said hull, a pump mounted in said hull and having inlet and exhaust ducts, said pump being operatively connected to said engine and said inlet duct being registered with said intake port, means including said exhaust duct for propelling said hull in response to operation of said engine and pump, said port having forward and aft edges extending transversely of said hull and opposite lateral edges extending longitudinally of said hull and a plurality of elongated members having leading and trailing ends, said members being spaced apart and extending longitudinally of said hull, the leading ends of first ones of said members being fixedly attached to said hull adjacent to the forward end of said port, the leading ends of second ones of said members being pivotally attached to said hull adjacent to the forward end of said port for swinging movement about axes extending transversely of said hull.

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