

June 18, 1963

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3,093,966

GATE ASSEMBLY

Filed Dec. 4, 1961

3 Sheets-Sheet 1

fig. 1.

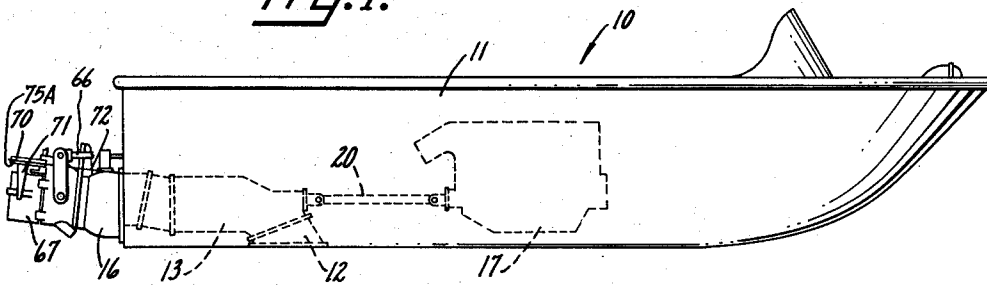


fig. 2.

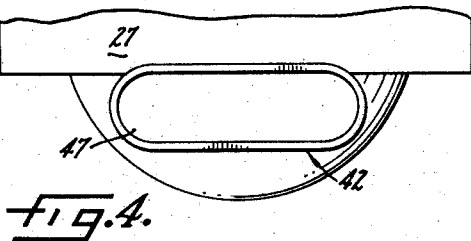
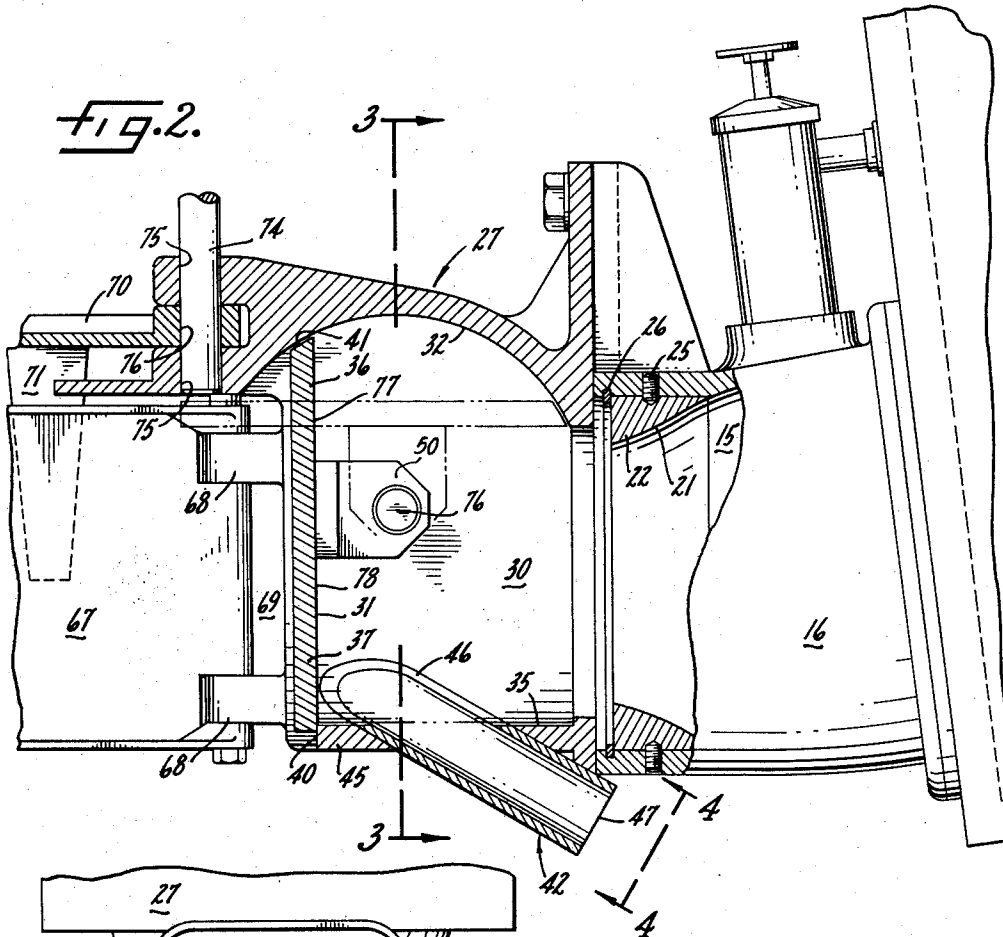


fig. 4.

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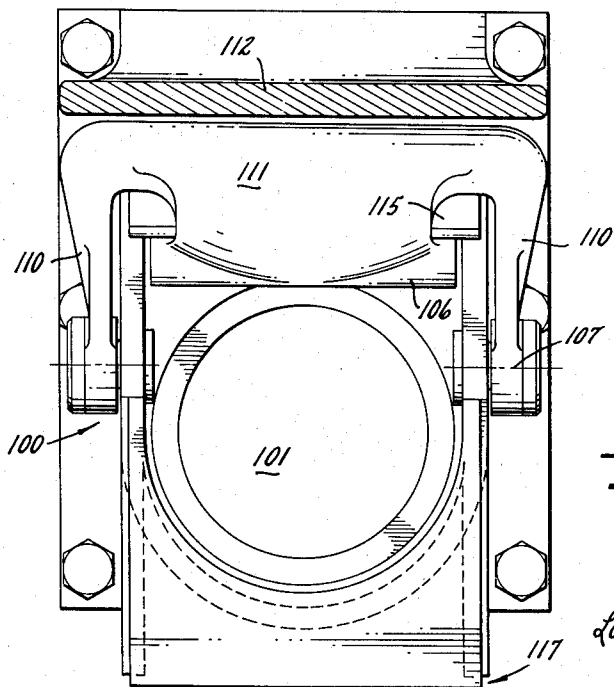
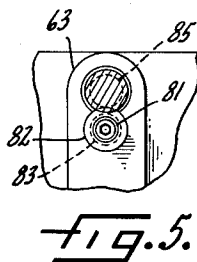
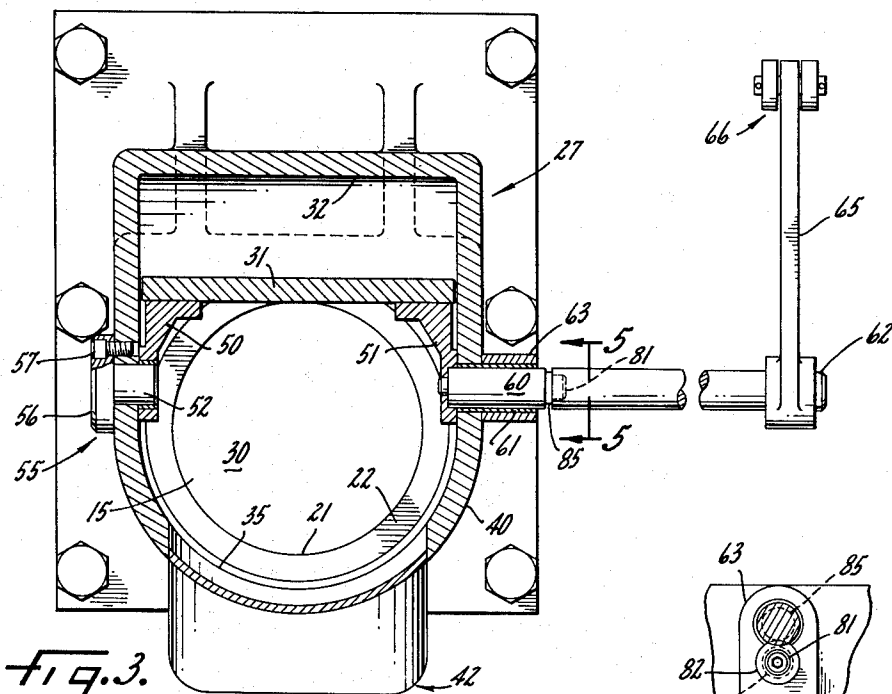
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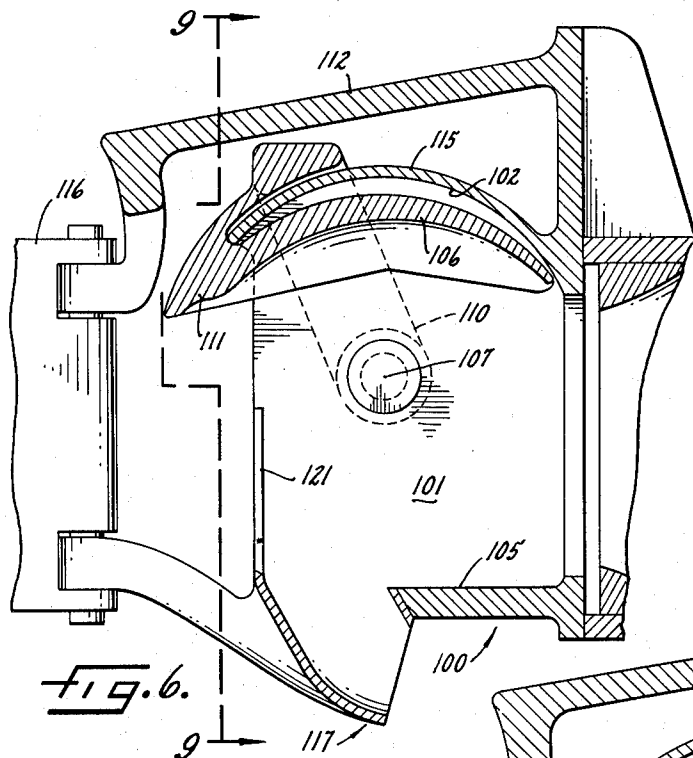


Fig. 6.

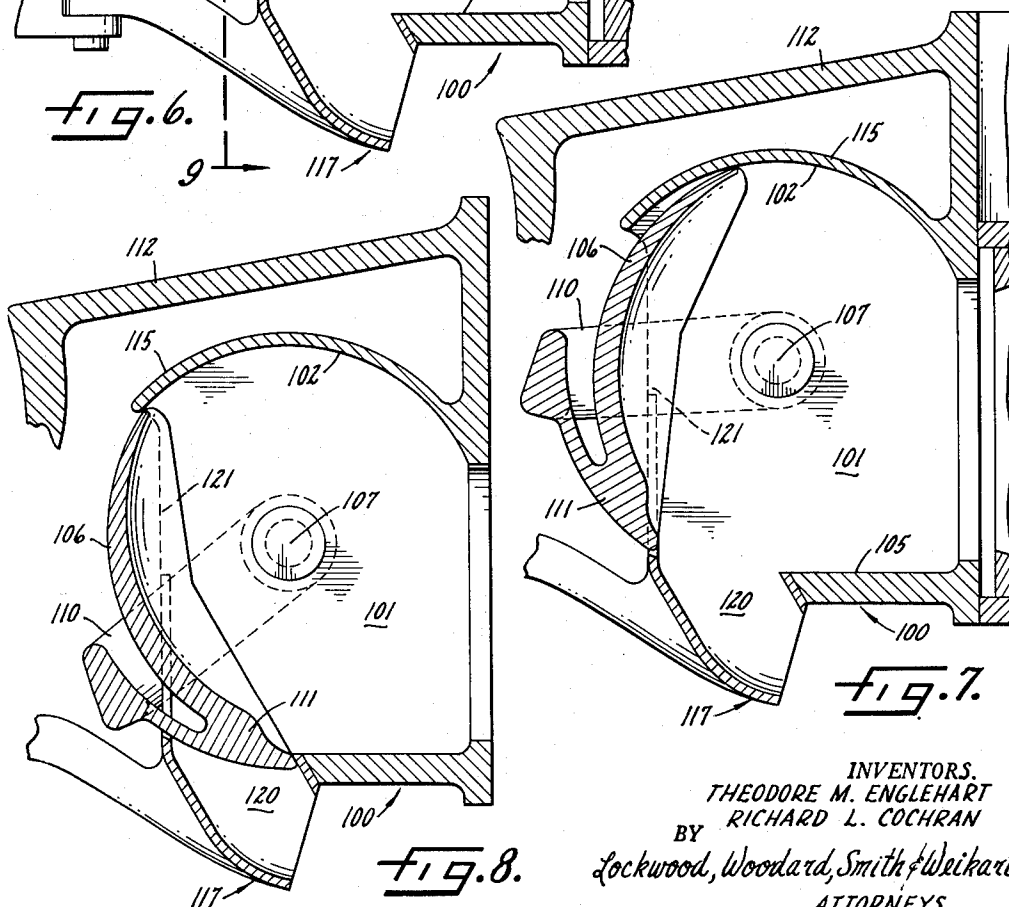


fig. 7.

Fig. 8.

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GATE ASSEMBLY

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7 Claims. (Cl. 60—35.54)

The present invention relates to jet propelled watercraft and more particularly to a means for controlling the direction of such craft.

One form of jet propelled boat incorporates an engine operatively connected to a pump located within a conduit extending through the boat from an intake opening at the bottom of the boat to an exhaust at the rear of the boat. Water is drawn into the conduit through the intake opening and is exhausted in a stream from the rear of the boat causing the boat to move forwardly. The direction of movement of the boat is controlled by deflecting the stream of water as it leaves the rear of the boat. For example, the stream could be deflected so as to cause the stream to flow beneath and forwardly of the boat causing the boat to move in reverse.

A primary object of the present invention is to provide in a jet boat improved means for controlling the direction of flow of the water as it leaves the boat and thus, controlling the direction of movement of the jet boat.

A further object of the present invention is to provide a jet boat direction control incorporating a balanced moments principle making the operation of the control easier for the operator.

Still another object of the present invention is to provide a jet boat direction control including not only a balanced flow neutral position but also a no flow neutral position.

Related objects will become apparent as the description proceeds.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

FIG. 1 is a side elevation of a jet boat incorporating the novel direction control of the present invention.

FIG. 2 is an enlarged longitudinal vertical section of the rearward portion of FIG. 1 showing in detail the direction control of the present invention.

FIG. 3 is a vertical transverse section taken along the line 3—3 of FIG. 2 in the direction of the arrows.

FIG. 4 is a fragmentary view taken along the line 4—4 of FIG. 2 in the direction of the arrows.

FIG. 5 is an enlarged fragmentary view taken along the line 5—5 of FIG. 3 in the direction of the arrows.

FIG. 6 is a longitudinal section similar to FIG. 2 of an alternative embodiment of the present invention.

FIGS. 7 and 8 are views similar to FIG. 6 showing different operating positions of the structure of FIG. 6.

FIG. 9 is a vertical section taken along the line 9—9 of FIG. 6 in the direction of the arrows.

Referring now more particularly to the drawings, there is illustrated a jet boat 10 having a hull 11, the hull being provided with an intake opening 12 communicating between the bottom of the boat and a pump 13. The pump 13 has a passage therethrough communicating between the intake opening 12 and a passage 15 through a tailpipe 16 secured to the rear of the boat. The pump 13 is driven by a conventional marine engine 17 by means of shaft 20 and functions to pump water from the intake 12 to and out of the rear of the boat. The water is constricted into a stream by the converging surface 21 of an annular member 22 fixed within the passage 15 by means of set-screws 25 and a snap ring 26.

Fixed to the tailpipe 16 is a housing 27 which has a

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hollow interior 30 within which is received a pivotally mounted gate or pate 31. Referring to FIG. 3, the hollow interior 30 is aligned with the passage 15 through the tailpipe so that the stream of water passing through the annular member 22 can pass directly through the housing 27 when the gate is in its upward position as shown in FIG. 3. The upper surface 32 of the hollow interior 30 has a generally cylindrical shape which curves about an axis transverse of the boat. The lower surface 35 of the hollow interior 30 is also cylindrical in shape but curves about a front-to-rear axis and is coaxial with the passage 15 and the annular member 22.

It can be appreciated that the gate 31 is generally rectangular at its upper portion 36 so as to conform to the shape of the upper surface 32, but is semi-circular at its lower portion 37 so as to conform to the shape of the lower surface 35. When the gate is in its vertical position as shown in solid lines in FIG. 2, the lower semi-circular portion 37 of the gate slightly overlaps and covers the lower rearward edge 40 of the housing 27. At its upper edge 41, the gate is curved from one face to another into a radius coaxial with the upper surface 32 of the hollow interior 30 so that the upper surface 41 of the gate is as close as possible to the surface 32 to prevent or at least allow only a nominal amount of water to pass between the upper gate surface 41 and the surface 32 of the housing.

A flat conduit 42 is mounted within the lower portion 45 of the housing and has an upper edge 46 which is flush with the lower surface 35 of the hollow interior 30. The conduit 42 leads downwardly and forwardly from the housing 27 at such an angle that water passing into the conduit 42 will be exhausted from the exit end 47 of the conduit beneath the boat and in a direction forward of the boat.

When the gate 31 is in the position of FIG. 2, all flow out the rear of the housing is cut off and redirected through the conduit 42. Since the flow out the exit 47 is in a direction forward of the boat, a reverse thrust will be produced on the boat causing it to move rearwardly.

The gate 31 is fixed to arms 50 and 51 located inside of the housing 27 but out of the path of the jet stream flowing from the annular member 22 (FIG. 3). The arm 50 is pivotally mounted upon a cylindrical portion 52 of a member 55, the enlarged head portion 56 of which is fixed to the housing by means of a screw 57. The arm 51 is fixed to a shaft 60 rotatably mounted within a bearing 61 fixed to the housing 27 and received within an elongated member 63 extending longitudinally of the craft. The shaft 60 has a lever 65 fixed to the distal end 62 thereof. The lever 65 may be pivoted by means of a linkage 66 extending into the boat whereby the gate 31 may be pivoted to the solid and dotted line positions of FIG. 2 and to various other intermediate positions.

A pair of deflectors 67 are pivoted to the housing 27 by means of suitable shafts extending through projections 68 extending from the housing. The deflectors 67 are located on opposite sides of the rearward exit 69 of the housing whereby the jet flow therefrom may be deflected in a horizontal direction by pivoting one or the other of the deflectors 67 inwardly and into the jet. Deflector pivoting is accomplished by means of a steering quadrant 70 having two downwardly extending projections 71 located on the outside of the deflectors 67. The steering quadrant 70 is pivotally mounted upon the housing 27 by means of a shaft 74 extending through bores 75 in the housing and bore 76 through the steering quadrant. The operation of a suitable steering wheel (not shown) or other steering means within the craft causes swinging of the quadrant by means of an operative connection between the steering wheel and a steering line 72 extending from

the boat around a groove 75A in the quadrant and back into the boat.

It should be emphasized that when the gate 31 is in the solid line position of FIG. 3 or the dotted line position of FIG. 2, it is out of the jet stream and does not hinder or interfere with direct rearward flow of the stream between the deflectors 67. When the gate is moved slightly from the dotted line position of FIG. 2 toward the solid line position thereof, the rearward flow of the jet tends to produce a moment about the axis 76 of the shafts 52 and 60 assisting the operator in downwardly pivoting of the gate. The jet stream, however, will also tend to resist such downward pivoting because the lower edge 31 of the gate will cause downward deflection of the jet producing a reaction force tending to hold the gate in its upward position. This reaction force will be much greater than the force tending to pivot the gate downwardly and thus, the total resultant force will be one tending to hold the gate in the upward dotted line position. This resisting force will not be so great as to interfere appreciably with downward pivoting of the gate and also will aid the operator in pivoting the gate to its upper horizontal position.

Continued downward movement of the gate toward the solid line position of FIG. 2 will cause a certain amount of the water to move upwardly into the upper cylindrical portion of the hollow interior 30. This water will produce a static pressure in the upper portion which will produce a force against the upper inner surface 77 of the gate tending to assist swinging of the gate into its vertical solid line position. It can be appreciated that the force acting against the lower inside surface 78 of the gate will tend to balance the force acting against the upper inside surface 77, thus cancelling the moments about the axis 76 and facilitating easy positioning of the gate.

When the gate is in the vertical position of FIG. 2, the forces acting on the gate will be determined by the static pressure within the housing 27 and the relative areas of the gate above and below the axis 76 about which the gate is pivoted. Since the upper portion 36 of the gate is square in shape and the lower portion 37 is semi-circular in shape, the lower portion area will be correspondingly reduced. Preferably, the lower portion area will be slightly less than the upper portion area whereby the gate will be held in the solid line position of FIG. 2 by means of the static pressure within the housing and the abutting of the lower portion of the gate against the rearward lower surface 40 of the housing 27. By so constructing the present apparatus, the need for a locking means for holding the gate in its vertical position is eliminated.

Referring to FIG. 5, the details of the means for locking the shaft 60 against axial movement are illustrated. The bearing 61 is received within the member 63 which is bored for reception of the bearing and is fixed to the housing. The member 63 threadedly receives a screw 81 which fixes a washer 82 and a spacer 83 in position, the spacer being beneath the washer. The washer 82 extends into an annular slot 85 in the shaft 60. Since the washer 82 is fixed in position, the shaft 60 cannot move axially away from the gate arm 51 to which it is keyed.

FIGS. 6-9 illustrate an alternative embodiment of the invention which is similar to the above described embodiment in that it includes a housing 100 having a hollow interior 101, the upper portion of which is defined by a cylindrical surface 102 which curves about a transverse axis, and the lower portion of which is defined by a cylindrical surface 105 which curves about a front-to-rear longitudinal axis. The gate 106 is swingably mounted about axis 107 by means of arms 110 which are positioned outside of the housing 100. In order to permit mounting of the gate upon the arms 110, the gate has a peculiar U-shape cross section at 111. The housing 100 also includes a shroud portion 112 which surrounds and covers the cylindrical upper portion 115 of the housing and which also provides a pivotal mounting for deflectors 116 similar to the above described deflectors 67.

The present embodiment is distinguished from the above described embodiment in that it has a full cut-off position as shown in FIG. 8 wherein the gate 106 completely closes off or bottles up all exits to the housing 100. The housing 100 includes a conduit 117 formed integrally with the housing and constructed similarly to the conduit 42 above described. When the gate is in the position of FIG. 8, the entrance 120 to the conduit 117 is closed off so that no water passes through the conduit 117.

The gate 106 may be pivoted to the position shown in FIG. 7 wherein all flow through the rearward exit 121 of the housing is cut off and redirected through the conduit 117 to provide rearward movement of the craft. The gate may be pivoted upwardly to a position intermediate of the positions of FIGS. 6 and 7 where a balanced flow neutral is provided. In other words, one portion of the flow from the pump moves out through the rearward exit 121 of the housing and provides a thrust which is balanced by the thrust provided by the water moving out of the housing through the conduit 117.

If desired, a tap may be located between the pump and the tailpipe or possibly even on the housing 100 for providing water under pressure for irrigation, fire fighting or other purposes. When it is desired to provide water through this tap, the gate is positioned as in FIG. 8, thus cutting off all flow through the rearward exit 121 or the conduit 117.

In all other respects, the gate assembly of FIGS. 6-9 is identical to the gate assembly of FIGS. 1-5. For example, the gate of FIGS. 6-9 uses the same balancing concept as the gate of FIGS. 1-5 and also is out of the jet stream during forward movement.

From the above description, it will be evident that the present invention provides an improved gate assembly for use on jet boats. It will also be evident that the butterfly arrangement of the present invention makes possible high speed, forward movement of the boat without the gate interfering with or reducing rearward thrust by frictional engagement with the water jet. It will also be evident that the particular manner in which the gate is mounted provides a balancing action making the operation of the controls of the boat to pivot the gate relatively easy.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention and the scope of the claims are also desired to be protected.

The invention claimed is:

1. A direction control system for watercraft comprising a straight conduit mounted on the craft and having an exit opening externally of the craft, said conduit having a necked-down portion adjacent said exit, means for pumping water through said conduit to be formed into a jet by said necked-down portion and to then exhaust in a jet from said exit, a gate pivotally mounted within said conduit between the necked-down portion and the exit, said conduit having a recess in the inside wall thereof between the necked-down portion and the exit, said gate being pivotal to a position closing off said conduit exit and to a position wherein said gate is received in said recess out of the path of said water flowing through said conduit.

2. A direction control system for watercraft comprising a straight conduit mounted on the craft and having an exit opening externally of the craft, said conduit having a necked-down portion adjacent said exit, means for pumping water through said conduit to be formed into a jet by said necked-down portion and to then exhaust in a jet from said exit, a gate pivotally mounted within said conduit between the necked-down portion and the exit for pivoting about an axis transverse to said conduit

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and in the path of said jet, said gate being pivotal to a first position closing off said exit and to a second position wherein said gate is between the necked-down portion and the exit and is out of the path of water flowing through said conduit, said gate being positioned to the rear of said axis when in said first position and transversely of said axis when in said second position.

3. A direction control system for watercraft comprising a conduit mounted on the craft and having an exit opening rearwardly thereof, means for pumping water through said conduit to exhaust in a jet from said exit, a housing secured to said conduit and covering the exit thereof, said housing having an opening rearwardly of and aligned with said conduit exit, a gate pivotally mounted within said housing for pivoting about a transversely extending horizontal axis, said housing defining a recess therein which is out of registry with said conduit exit and out of the path of said jet, said gate being pivotal to a first position closing off said housing opening and to a second position wherein said gate is received in the housing recess out of the path of said jet, said gate being mounted on spaced arms which are positioned out of registry with said conduit exit and out of the path of said jet when said gate is in said second position.

4. A direction control system for watercraft comprising a conduit mounted on the craft and having an exit opening rearwardly thereof, means for pumping water through said conduit to exhaust in a jet from said exit, a housing secured to said conduit and covering the exit thereof, said housing having an opening rearwardly of and aligned with said conduit exit, a gate pivotally mounted within said housing for pivoting about a transversely extending horizontal axis, said housing defining a recess therein which is out of registry with said conduit exit and out of the path of said jet, said gate being pivotal to a position closing off said housing opening and to a position wherein said gate is received in the housing recess out of the path of said jet, a further conduit leading from said first conduit and leading forwardly and downwardly from said first conduit beneath said craft, said housing being watertight except for said opening and said further conduit.

5. A direction control system for watercraft comprising a straight conduit mounted on the craft and having an exit opening rearwardly thereof, means for pumping water through said conduit to exhaust in a jet from said exit, a housing secured to said conduit and covering the exit thereof, said housing having a semi-cylindrically shaped lower portion extending directly rearwardly from said conduit and an upper portion of equare transverse cross section, said upper portion having a downwardly facing convex shape, said housing having an opening rearwardly of and aligned with said conduit exit, a plate pivotally

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mounted within said housing for pivoting about a transversely extending horizontal axis in the path of said jet, said plate being pivotal to a vertical position closing off said housing opening and to a horizontal position wherein said plate is received in the upper portion of said housing out of the path of said jet, said plate being positioned above said axis when in said horizontal position and to the rear of said axis when in said vertical position, a further conduit formed integrally on the lower portion of said housing and leading forwardly and downwardly from said housing beneath said craft.

6. A direction control system for watercraft comprising a straight conduit mounted on the craft and having an exit opening rearwardly thereof, means for pumping water through said conduit to exhaust in a jet from said exit, a housing secured to said conduit and covering the exit thereof, said housing having a semi-cylindrically shaped lower portion extending directly rearwardly from said conduit and an upper portion of square transverse cross section, said upper portion having a downwardly facing convex shape, said housing having an opening rearwardly of and aligned with said conduit exit, a gate pivotally mounted within said housing for pivoting about a transversely extending horizontal axis in the path of said jet, said gate being pivotal to a first position closing off said housing opening and to a second position wherein said gate is received in the upper portion of said housing out of the path of said jet, said gate being positioned above said axis when in said second position and to the rear of said axis when in said first position, a further conduit formed integrally on the lower portion of said housing and leading forwardly and downwardly from said housing beneath said craft, said gate being pivotal to a third position wherein said gate closes off said rearward opening and said further conduit.

7. The direction control system of claim 5 in which said plate comprises two portions, one of which is located above said axis and the other of which is located below said axis when said plate is in said vertical position, said other portion of said plate engaging said lower portion of said housing when said plate is in said vertical position, said one portion being larger in area than said other portion to yieldably hold said plate in said vertical position by the pressure of the water within said housing.

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