Feb. 4, 1964 D. L. HOWARD 3,120,102

TUBULAR TYPE GATE

Filed Jan. 22, 1962

Fig. 1.

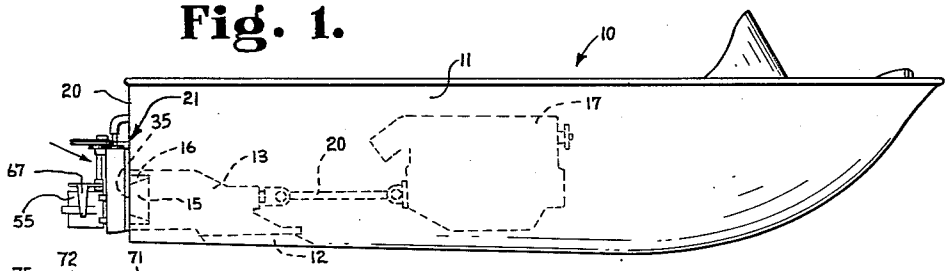


Fig. 2.

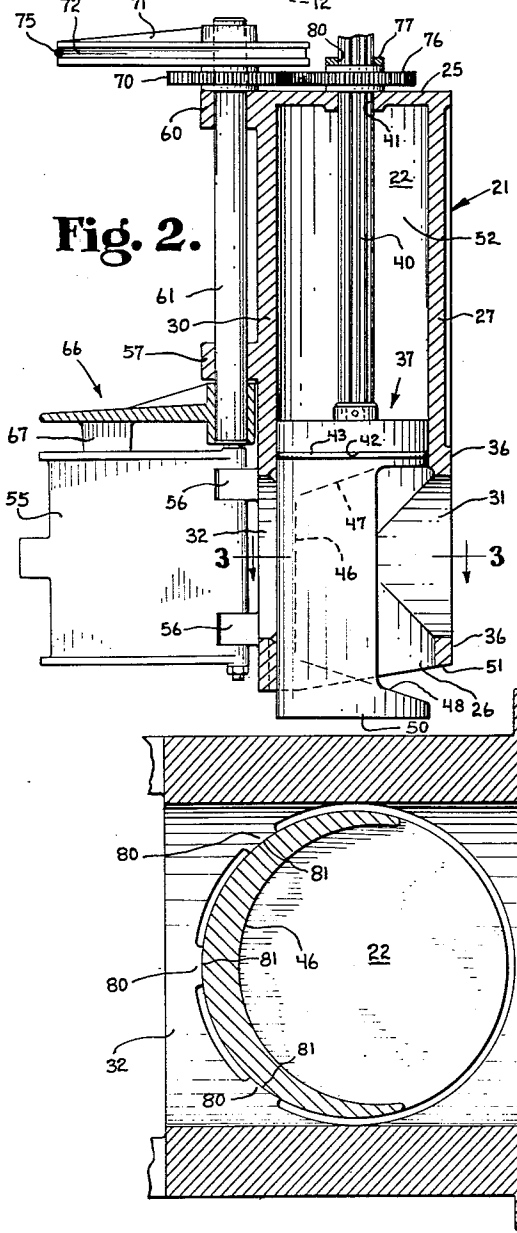


Fig. 4.

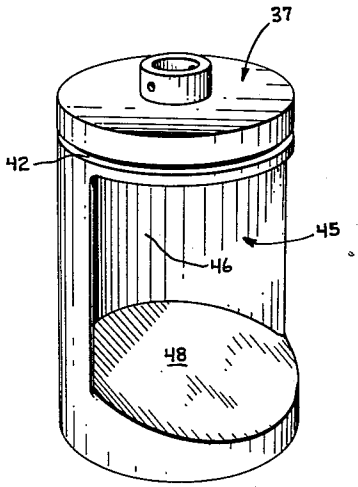


Fig. 3.

INVENTOR.
DONALD L. HOWARD

BY

Lockwood, Woodard, Smith & Weikart
Attorneys

United States Patent Office

3,120,102

Patented Feb. 4, 1964

3,120,102

TUBULAR TYPE GATE

Donald L. Howard, Indianapolis, Ind., assignor to The Buehler Corporation, Indianapolis, Ind., a corporation of Indiana

Filed Jan. 22, 1962, Ser. No. 167,763
4 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 type of jet propelled watercraft incorporates an engine operatively connected to a pump received within a conduit extending through the craft. This conduit leads from an intake opening at the bottom of the boat to an exhaust at the rear of the boat. Water passes into the conduit through the intake opening and is exhausted in a stream from the rear of the craft causing it to move forwardly. The direction of movement of the boat or craft 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 it to flow in a direction which is beneath and forwardly of the boat causing the boat to move rearwardly.

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 so as to control the direction of movement of the jet boat.

A further object of the invention is to provide a jet boat direction control which provides steering in reverse at fast as well as slow reverse speeds.

Still another object of the present invention is to provide a jet boat direction control incorporating means for reducing or eliminating sand jamming.

Still a further object of the present invention is to provide a jet boat direction control which may be operated by a single steering means within the boat to control steering in reverse as well as during forward movement.

Related objects and advantages will become apparent as the description proceeds.

One embodiment of the present invention includes a direction control system incorporating a straight conduit mounted on the craft and having an exit opening externally of the craft. There is provided means for pumping water through the conduit to exhaust in a jet from the exit. A piston type gate is reciprocally mounted within the conduit for movement between a first position wherein the gate is out of the path of the water and a second position wherein the gate is in the path of water flowing through the conduit. The gate has a curved surface on its forward face against which the water impinges when the gate is in the second position for redirecting the flow of the water in a direction opposite to that through the conduit. The piston type gate is rotatable about an axis parallel to the direction of reciprocation thereof for changing the angle of redirection of the water.

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 direction control system of the present invention.

FIG. 2 is an enlarged vertical section of the rearward portion of FIG. 1.

FIG. 3 is an enlarged horizontal section taken along the line 3—3 of FIG. 2 in the direction of the arrows.

FIG. 4 is a perspective view of a gate forming a part of the direction control system.

Referring now more particularly to the drawings, there is illustrated a jet boat **10** having a hull **11**. The hull is 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 converging passage **15** through an annular member **16** fixed within the exit end of the pump **13**. The pump **13** is driven by a conventional marine engine **17** by means of a shaft **20** and functions to pump water from the intake **12** to and through the converging passage **15** whereby the water is constricted into a stream and passes out of the rear of the boat.

Fixed to the transom **20** of the boat is a housing **21** which has a hollow cylindrical, vertically extending interior **22**. The housing **21** has a closed upper end **25** and an open lower end **26**. Formed through the forward wall **27** and rearward wall **30** of the housing are respective cylindrical apertures **31** and **32** which are slightly larger than the exit opening **35** of the annular member **16** and are coaxial with this exit opening. The housing **21** is fixed to the transom of the boat in such a manner that the surface **36** of the housing engages the transom and provides a seal insuring that all water flow from the exit opening **35** flows through the aperture **31** in the housing.

A piston type gate **37** is reciprocally received within the housing **21** and has a splined shaft **40** fixed to its upper surface. The shaft **40** is coaxial with the cylindrically shaped gate **37** and extends upwardly through a suitable opening **41** in the upper end **25** of the housing. Suitable means (not shown) hydraulic or otherwise, are provided for raising and lowering the splined shaft **40** and gate **37**. Such means, which are conventional, may be mounted upon the transom **20** or upon the upper surface **25** of the housing **21**.

The gate **37** has an annular recess **42** adjacent its upper end. This recess receives an O-ring seal **43** which is made of a suitable material for withstanding abrasive action of sand received within the housing, yet with sufficient elasticity to seal the upper portion of the housing from the lower portion.

The forward face of the gate has a cup-shaped recess **45** therein. This recess has a generally cylindrically shaped rearward surface **46** which extends through approximately 90° and has sloping upper and lower surfaces **47** and **48**, the upper surface **47** sloping rearwardly and downwardly and lower surface **48** sloping forwardly and downwardly. The gate **37** is rotatable within the hollow interior **22** about its own axis and the axis of the splined shaft **40**. When the gate is in the position of FIG. 2, water passing from the exit end **35** of the member **16** will move through the forward wall aperture **31** into the cup-shaped recess **45** of the gate. It will be noted that the lower end **50** of the gate is extending downwardly below the housing **21**. This lower end **50** should also extend a sufficient distance downwardly that the water moving into the cup-shaped recess **45** will be redirected by the surfaces **47**, **46** and **48** into a direction beneath and forwardly of the boat. Such redirecting of the flow from the pump **13** causes rearward movement of the boat.

The gate **37** may be moved upwardly by the above mentioned means to a position wherein the lower portion **50** of the gate is above the lower edge **51** of the housing **21** and the cup-shaped recess **45** is covering the forward wall aperture **31** of the housing. In this position, all flow from the pump is cut off and "bottled up" by the gate whereby the boat is in neutral and no forward or rearward thrust is produced.

The gate may be moved upwardly into the upper portion **52** of the hollow interior **22** and with the lower portion **50** of the gate above the apertures **31** and **32**. When the gate is in this position, the jet flow from the member **16** passes directly through the openings **31** and **32** with none or only a nominal portion of the jet stream

engaging the housing. When the jet stream is so allowed to flow without interference of the gate and housing, the boat moves forwardly. A pair of deflectors **55** are pivoted to the rearward wall **30** of the housing about vertical axes on opposite sides of the aperture **32**. Projections **56** from the rearward wall have suitable apertures therethrough which receive suitable shafts pivotally mounting the deflectors. A further pair of projections **57** and **60** pivotally receive a vertical quadrant shaft **61** which has a steering quadrant **66** fixed to its lower end. The shaft **61** is pivotal about an axis directly between the axes of pivoting of the deflectors **55**. The steering quadrant **66** has a pair of depending projections **67** integral therewith and extending downwardly on the outside of the respective deflectors **55**. Pivoting of the steering quadrant **66** by means of the shaft **61** causes one or the other of the depending projections **67** to pivot inwardly and to pivot a respective deflector **55** inwardly into the jet stream passing out of the aperture **32** for dedirecting the jet stream through various angles in a horizontal plane whereby the boat may be steered.

At the upper end of the quadrant shaft **61**, there is fixed a spur gear **70** and a semi-cylindrical member **71** having a semi-cylindrical groove **72** on the external periphery thereof. A steering line **75** is received within this groove and passes into the boat where it is connected to suitable steering means such as a steering wheel or the like. The spur gear **70** meshes with a further spur gear **76** received about the splined shaft **40**. The gear **76** has a plurality of inwardly projecting teeth (not shown) which are complementary with the splines on the shaft **40** whereby rotation of the gear **76** also rotates the shaft **40**. It should be understood that the shaft **40** is, however, vertically reciprocal through the gear **76**. A suitable gear retaining member **77** is fixed to the upper end **25** of the housing **21** and functions to retain the gear **76** in the illustrated vertical position. The member **77** is provided with a suitable aperture **80** through which the shaft **40** extends.

When the gate is in the position of FIG. 2 and is redirecting water flow in a direction beneath and forwardly of the boat, the boat may be steered by operation of the boat steering means to rotate the quadrant shaft **61**. Rotation of shaft **61** also causes rotation of gears **70** and **76** and the gate **37** through the shaft **40** causing the water leaving the gate to have a direction, one component of which is transverse to the boat.

At the lower end **26** of the housing, the hollow interior **22** has a somewhat greater diameter than at the upper portion **52** thereof. There are also formed vertically extending ribs **80**, the inner surface **81** of which has a radius equal to the radius of the upper portion **22** of the housing. The ribs **80** prevent the gate from wedging as the result of sand within the hollow interior **22** of the housing. These ribs also reduce the amount of sand which will be forced up into the upper portion **22** of the housing and make possible scraping of sand from the gate by rotation of the gate within the housing.

From the above description, it will be obvious that the present invention provides improved jet boat direction control means. It will also be clear that the present invention provides a direction control means making possible steering in reverse at fast as well as slow speeds. It will be further evident that the present invention provides a jet boat direction control incorporating means for reducing or eliminating sand jamming of the control. The direction control of the present invention also makes possible steering both in reverse and when moving forwardly by means of a single steering wheel or the like in the boat.

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 rearwardly thereof, means for pumping water through said conduit to exhaust in a jet from said exit, a housing secured to said craft and covering the exit thereof, said housing having a vertically extending cylindrical hollow interior, said housing having coaxial cylindrical apertures in the forward and rearward walls thereof opening into said hollow interior and in registry with said conduit exit, a cylindrical gate vertically reciprocal within said cylindrical hollow interior, said housing having a closed upper end and an open lower end, said gate being vertically movable between three positions in a first of which said gate is received in the upper portion of said housing above said apertures so that the jet from said conduit passes through said housing apertures directly rearwardly of said craft, in a second of which said gate is positioned rearwardly of said front wall aperture and seals off flow from said housing, and in a third of which said gate is positioned rearwardly of said front wall aperture and extends downwardly below said housing, said gate having a cup-shaped forward face which redirects flow from said conduit exit in a direction forward of and beneath said craft when said gate is in said third position, said cylindrical gate being rotatable about its axis for changing the angle of redirection of said water when said gate is in said third position.

2. 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 craft and covering the exit thereof, said housing having a vertically extending cylindrical hollow interior, said housing having coaxial cylindrical apertures in the forward and rearward walls thereof opening into said hollow interior and in registry with said conduit exit, a cylindrical gate vertically reciprocal within said cylindrical hollow interior, said housing having a closed upper end and an open lower end, a splined shaft fixed to the upper end of said gate coaxially therewith and extending upwardly through the closed upper end of said housing, said gate being vertically movable by said splined shaft between three positions in a first of which said gate is received in the upper portion of said housing above said apertures so that the jet from said conduit passes through said housing apertures directly rearwardly of said craft, in a second of which said gate is positioned rearwardly of said front wall aperture and seals off flow from said housing, and in a third of which said gate is positioned rearwardly of said front wall aperture and extends downwardly below said housing, said gate having a cup-shaped forward face which redirects flow from said conduit exit in a direction forward of and beneath said craft when said gate is in said third position, a first spur gear coaxially received on said splined shaft and above said housing, said spur gear having inwardly projecting teeth complementary to the splines on said splined shaft whereby rotation of said gear rotates said splined shaft and said gate for changing the angle of redirection of said water when said gate is in said third position, means for retaining said spur gear adjacent said housing, means for deflecting the jet as it moves out of the rearward wall aperture, a further spur gear fixed to said deflecting means and movable therewith, said further spur gear being in meshing engagement with said first spur gear whereby movement of said deflecting means produces corresponding rotation of said gate, and means within the craft for operating said jet deflecting means.

3. 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 craft and covering the exit thereof, said housing having a vertically extending cylindrical hollow interior, said housing having coaxial cylindrical apertures in the forward and rearward walls thereof opening into said hollow interior and in registry with said conduit exit, a cylindrical gate vertically reciprocal within said cylindrical hollow interior, said housing having a closed upper end and an open lower end, a splined shaft fixed to the upper end of said gate coaxially therewith and extending upwardly through the closed upper end of said housing, said gate being vertically movable by said splined shaft between three positions in a first of which said gate is received in the upper portion of said housing above said apertures so that the jet from said conduit passes through said housing apertures directly rearwardly of said craft, in a second of which said gate is positioned rearwardly of said front wall aperture and seals off flow from said housing, and in a third of which said gate is positioned rearwardly of said front wall aperture and extends downwardly below said housing, said gate having a cup-shaped forward face which redirects flow from said conduit exit in a direction forward of and beneath said craft when said gate is in said third position, a spur gear coaxially received on said spined shaft and above said housing, said spur gear having inwardly projecting teeth complementary to the splines on said splined shaft whereby rotation of said gear rotates said splined shaft and said gate for changing the angle of redirection of said water when said gate is in said third position, a pair of deflectors pivoted to said housing on opposite sides of said rear wall aperture, a quadrant shaft rotatably mounted on said housing about a vertical axis between the axis of pivoting of said deflectors, a steering quadrant fixed to said quadrant shaft and having a pair of depending projections located outside of said deflectors whereby pivoting of said quadrant shaft pivots one of said projections and a respective deflector inwardly to

deflect the jet passing out of said rear wall aperture, a spur gear fixed to said quadrant shaft and meshing with said first spur gear whereby rotation of said quadrant shaft also rotates said gate, and means for rotating said quadrant shaft.

4. A direction control system for watercraft comprising a conduit mounted on the craft and having a straight cavity with an exit opening rearwardly thereof, means for pumping water through said conduit to exhaust in a jet from said exit, said conduit having a vertically extending cylindrical hollow interior adjacent its exit and intersecting said straight cavity, said vertically extending hollow interior extending above and below said cavity and having a closed upper end and an open lower end, a cylindrical gate vertically reciprocal within said cylindrical hollow interior, said gate being vertically movable between three positions in a first of which said gate is received in the upper portion of said interior above said cavity so that the water from said pumping means passes through said interior and cavity directly rearwardly of said craft, in a second of which said gate is positioned in alignment with said cavity sealing off flow from said exit and from the lower end of said interior, and in a third of which said gate is positioned rearwardly of said front wall aperture and extends downwardly below said conduit, said gate having a cup-shaped forward face which redirects flow from said interior lower end in a direction forward of and beneath said craft when said gate is in said third position, said cylindrical gate being rotatable about its axis for changing the angle of redirection of said water when said gate is in said third position.

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