The present invention relates to jet propelled watercraft and more particularly to means for controlling the movement of such craft, said means finding important utility as a steering device for such craft.

One type of water jet propelled boat includes a conduit having an intake opening at the bottom of the boat and an exhaust opening at the rear of the boat. Water is pumped through the conduit by an engine arranged to drive a pump located within the conduit. One problem present in the construction and operation of such water jet propelled boats is that of controlling movement of the boat, such as, for example, the steering of the boat. This control may be accomplished by deflecting the stream of water as it leaves the rear of the boat. It is desirable that efficient, inexpensive, easily installed means be provided for deflecting the stream to control the movement of the boat.

Consequently, an important object of the present invention is to provide an improved jet boat control system.

Further objects of this invention are to provide a jet boat steering system which is inexpensive and incorporates elements at points of greater wear which can be easily and inexpensively replaced; to provide a jet boat steering system which eliminates or reduces spray during turning, and to provide a jet boat steering system which is easy to operate and highly efficient in operation.

Related objects and advantages become apparent as the description proceeds.

In accordance with the present invention, there is provided a control system for watercraft including means for moving water in a jet from the craft, a flexible conduit mounted on the craft to receive the jet and means for moving the flexible conduit to deflect the jet.

The full nature of the invention will be understood from the accompanying drawings and the following description and claim:

FIG. 2 is a longitudinal vertical section of the rearward portion of FIG. 1, showing in detail the steering control of the present invention.

FIG. 3 is a fragmentary top view of the structure illustrated in FIG. 2.

FIG. 4 is a horizontal section taken along the line 4—4 of FIG. 2 in the direction of the arrows but showing the device in a different operating position.

FIG. 5 is a view similar to FIG. 4 of an alternative embodiment of the present invention.

FIG. 6 is a view similar to FIG. 3 of a further alternative embodiment of the present invention.

Referring now more particularly to the drawings, there is illustrated a jet boat 10 having a hull 11 which is provided with an intake opening 12 communicating between the bottom of the boat and a pump 13. The pump has a passage therethrough communicating between the intake opening 12 and a passage 15 through a tail pipe 16 secured to the rear of the boat. The pump 15 is driven by a conventional marine engine 14 through a shaft 17 and functions to pump water from the intake 12 to and out of the rear of the boat. The water is formed into a jet stream by the converging surface 20 of an annular member 21 fixed within the passage 15.

Fixed to the tail pipe 16 is a housing 22 which contains a depending gate or slide 25 which is movable within the vertically extending opening 26 in the housing to various positions. There is provided suitable means 27 (FIG. 1), hydraulic or otherwise, for moving the gate 25 within the housing 22. The upward end of the opening 26 has a sufficiently great vertical dimension to receive the gate in the position shown in FIG. 2, whereby the jet stream issuing from the annular member 23 is free to move directly rearwardly through a circular aperture 27 in the rear of the housing to cause the craft to move forwardly. The gate 25 may be lowered to a position wherein it completely covers and closes off the aperture 27 causing the water issuing from the member 21 to be redirected and to flow downwardly through the forwardly opening aperture 30, thence downwardly and forwardly beneath the boat causing the boat to move rearwardly. The gate 25 is also movable to intermediate positions in one of which, for example, the forward and rearward thrust produced by flow through apertures 27 and 30, respectively, is balanced and the boat can maintain a stationary position.

A generally cylindrical flexible conduit 31 is fixed to the housing 22 by means of an annular mounting member 33 in such a manner that the flexible conduit is in registry with and surrounds the aperture 27 in the housing. The flexible conduit 31 has an outwardly extending annular flange 35 at its proximal end which is clamped beneath the mounting member 33 by screws 36 positioned around the aperture 27 whereby the flexible conduit is securely held to the housing and leakage cannot occur between the housing and flexible conduit.

The flexible conduit may be composed of rubber, plastic, canvas or similar materials. However, preferably it is formed of such a material that it retains its cylindrical rearwardly extending shape as shown in FIGS. 2 and 3 and does not sag or deform when water is not flowing through the conduit 31. Thus, when the gate 25 is in its illustrated uppermost position and the other parts of the assembly are in the illustrated position of FIGS. 1—3, the jet of water being expelled from the member 21 can pass directly rearwardly through the aperture 27 and through the flexible conduit 31 without contacting either the housing or the flexible conduit. It will be noted that both the aperture 27 and the flexible conduit 31 have a greater diameter than the exit end of annular member 21.

The housing 22 has formed integrally therewith a pair of spaced rearwardly projecting portions 37 which are located centrally of the housing and have vertical bores therethrough which pivotally receive a vertical shaft 40. A steering quadrant 41 is fixed to the shaft 40 and receives a steering line 42 in a peripheral groove 43 of the quadrant. The steering line 42 is connected to suitable steering apparatus such as the steering wheel within the craft.

Fixed to the lower end of the shaft 43 is a rigid annular member 46. The annular member 46 has taper forward edges 47 which are engageable with the lower portion of the gate 25 to permit the pivoting of the annular member about the axis of the shaft 40 to positions such as shown in FIG. 4. At its distal end 50, the annular member 46 has a circular cross section. Along the line 51 of FIG. 2, the annular member 46 has an elliptical cross section while at the portions between 50 and 51, the cross section of the member 46 is also elliptical but gradually changes between the two extremes at 50 and 51.

As can be seen from FIG. 2, the upper and lower portions 52 and 53 of annular member 46 have a slight taper rearwardly and toward one another but generally speaking the vertical dimension therebetween is approximatley equal to the vertical dimension between the top and bottom portions 55 and 56 of the flexible conduit. However, as is best seen in FIGS. 5 and 4, the annular...
member 46 tapers rearwardly in horizontal section from a size greater than the flexible conduit 31 to a size at the distal end 59 approximately the same as the flexible conduit. Consequently, when the rigid member 46 is pivoted to the position shown in FIG. 4, the forward edge 57 of the rigid member does not contact the flexible conduit 31 to produce a ridge or bump in the internal surface of the flexible conduit which would tend to interfere with the flow of water therethrough.

It will be seen that by means of the steering quadrant 41, the line 42, the steering wheel within the boat and the shaft 40, the annular member 46 may be pivoted to the position shown in FIG. 4 or to an opposite position or to intermediate positions for deflecting the stream of water and turning the boat. When the rigid member 46 is in the position of FIG. 4, a portion thereof extends past the rearward edge 69 of the flexible conduit and assists in the deflecting of the jet stream.

Referring to FIG. 5, there is illustrated an alternative embodiment of the present invention which is substantially identical to the above described embodiment with the exception that the annular member 70 at all times extends a greater distance rearwardly of the boat than does the flexible conduit 71. Further, the embodiment of FIG. 5 is provided with inwardly projecting flanges 72 which extend from the forward ends 73 of the spaced side portions 75 of the member 70. The inwardly projecting flanges 72 define at their inner edge 76 a circular orifice which slidably receives the flexible conduit 71.

In FIG. 5, there is also illustrated a different type of mounting plate 77 which has a forwardly extending portion 89 and a radially extending portion 81. The radially extending portion 81 receives a plurality of mounting screws 82 which fix the plate 77 to the housing 85 and compress the radially extending flange 86 on the flexible member providing a sealed and secure mounting.

In FIG. 6, there is illustrated a further embodiment of the invention which includes a cylindrical flexible member 90 mounted in the manner shown in FIGS. 1-4 upon a housing 91 identical to the housing 22. Alternatively, the flexible conduit 90 may be mounted as shown in FIG. 5 upon the housing 91. Except as further described below, the embodiment of FIG. 6 is identical to the embodiment of FIGS. 1-4.

Fixed to and located externally of the distal end of the flexible conduit is a rigid ring 92. A shaft 93 identical to the shaft 40 is pivotally mounted upon the housing and has fixed to its lower end an arm 95 which has fixed to its distal end the ring 92. The shaft 93 can be pivoted, for example, as shown in dotted lines in FIG. 6, to deflect the jet stream issuing from the housing 91.

From the above description, it will be evident that the present invention provides a steering mechanism for a jet boat which eliminates or reduces spray during turning of the boat. Thus, no spray can be ejected between the housing and the flexible conduit of any of the embodiments because of the sealed-together nature of these two members whereby all of the water must exit from the distal end of the flexible conduit. It will also be evident from the above description that the present invention provides an efficient, inexpensive and easily replaceable steering device for a jet boat. Since a large part of the wear in the steering mechanism will occur in the flexible conduit, it is an important advantage of the present invention that this flexible conduit is easily replaceable.

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:

A steering system for watercraft comprising a rigid conduit mounted on the craft and extending and opening rearwardly thereof, means for pumping water through said conduit to exhaust from said opening, said conduit being constricted at the opening thereof to form the water into a smooth jet, a flexible conduit of constant circular cross section fixed to and extending rearwardly of said craft in sealed communication with said rigid conduit opening, said flexible conduit having a greater diameter than the opening of said rigid conduit, a rigid annular member surrounding said flexible conduit and extending rearwardly of said watercraft substantially the same distance as said flexible conduit, said rigid annular member being pivoted to said craft for swinging about a vertical axis adjacent and bisecting said opening, said annular member tapering rearwardly in central front-to-rear horizontal section from a size substantially greater than said flexible conduit to a size approximately the same as said flexible conduit, said annular member having from front-to-rear an inside vertical spacing between its top and bottom portions which is approximately equal to the outside vertical spacing between the top and bottom portions of said flexible conduit from front-to-rear thereof, and means for swinging said annular member about said axis to horizontally deflect said flexible conduit, said rigid annular member being freely movable relative to said smooth flexible conduit.

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SAMUEL LEVINE, Primary Examiner.