ABSTRACT

A longitudinal flow passage opens at the bow of a ship and has impeller means therein with first and second discharge flow passages branching from the longitudinal passage behind the impeller and opening on both sides of the hull. Controllable valve means in the discharge flow passages control the flow of water therethrough with the water being discharged from openings whose rear edges project outwardly of the hull surface a distance about one fourth of the width of the discharge opening.

3 Claims, 3 Drawing Figures
STEERING DEVICE FOR SHIPS

The present invention relates to steering devices for ships, more particularly, to the structure and arrangement of discharge openings at the sides of the ship's hull in a bow control system.

One form of bow control device for a ship comprises a longitudinal flow passage having one end opening at the bow of the ship and having a impeller pump therein. Transverse discharge flow passages branch outwardly from the longitudinal flow passage on the downstream side thereof with respect to the impeller and open on the port and starboard sides of the hull. Controllable valves are mounted in the transverse passages to control the flow of water therefrom. The principal purpose of such a steering device is to impart satisfactory steering characteristics to the ship particularly at low speeds and, accordingly, these steering devices are generally mounted in the bow of the ship. It is also possible for such a steering device to be mounted in any other position of that portion of the hull which is below the water line.

In the operation of such a control device water is drawn through the longitudinal passage by the impeller, and then discharged through the discharge opening of one of the transverse branch passage. The discharged stream of water will impart a thrust to the ship's hull which will be opposite in direction to the flow of water from the transverse passage. As a result, there will be a corresponding lateral movement of the ship in the water.

While such a steering device is quite effective it has been discovered that the steering action decreases substantially as the speed of the ship increases. It was then discovered that this decrease in steering effect resulted from the discharged stream of water from a transverse opening flowing along the side of the hull instead of outwardly therefrom. Suction forces were thus set up which actually acted against the desired steering thrust on the ship. While such a steering device was effective and satisfactory at relatively slow speeds of the ship it was unsatisfactory as the speed of the ship increased.

It is therefore the principal object of the present invention to provide a novel and improved steering device for ships.

It is another object of the present invention to provide a steering device for ships utilizing discharged streams of water to impart a steering force wherein the steering effect is undiminished as the speed of the ship increases.

The objects of the present invention are achieved by the steering device of the present invention in aspect thereof there may be provided a longitudinal flow passage having one end opening to the hull surface and an impeller unit positioned within the longitudinal passage. First and second transverse flow discharge passages branch from the longitudinal flow passage on the downstream side of the impeller unit and have discharge openings on the port and starboard sides of the hull. Means are provided within the transverse flow passages for controlling the flow of water therefrom. The rearward edge of each discharge opening of the transverse flow passages projects outwardly from the hull surface a distance of about one fourth of the width of the discharge opening. It has been discovered that by constructing the discharge opening of the transverse passage in such a manner the water discharged therefrom is prevented from flowing against the hull surface even at relatively high speeds of the ships. Further, at least the rearward edge of the wall of the discharge opening projecting behind the hull surface is attached to the hull surface at about a right angle or at an acute angle thereto.

Other objects and advantages of the present invention will be apparent upon reference to the accompanying description when taken in conjunction with the following drawings, which are exemplary, wherein;

FIG. 1 is a sectional view taken along the horizontal plane of the steering device according to the present invention and illustrating the manner in which the discharge openings of the transverse flow passages extend outwardly from the hull surface;

FIG. 2 illustrates only the discharge opening portion according to FIG. 1 and shows a modification thereof;

and

FIG. 3 is a side elevational view of the discharge opening of either FIG. 1 or FIG. 2.

Proceeding next to the drawings wherein like reference symbols indicate the same parts throughout the various views a specific embodiment and modification of the present invention will be described in detail.

As may be seen in FIG. 1, a portion of a ship's bow is provided with a substantially longitudinal and horizontal flow passage 7 having an inlet opening subdivided by a bow stem 10 of the ship and has a cylindrical portion in which is mounted an impeller 3 driven by a motor 4 through a drive shaft 11. On the downstream side of the impeller 3 the flow passage 7 branches into a transverse discharge passage 5 on the starboard side of the ship and a transverse discharge passage 6 on the port side thereof. Both transverse passages 5 and 6 are positioned symmetrically with respect to the lateral plane of the ship.

Flaps 8 and 9 of known construction are mounted for pivotable movement in the passages 5 and 6 by a linkage which is not illustrated but which is known in the art and are employed to control the flow of water through the respective transverse passages.

The discharge openings of the transverse passages 5 and 6 are provided with cylindrical extensions 12 and 13 which are positioned approximately perpendicularly to the outer hull surface 2 of the ship. Each projects outwardly from the outer surface by a distance of at least one quarter of the internal width of the discharge opening. The rearward edges 17a of the cylindrical extensions 12 and 13 are attached to the outer hull surface 2 of the ship at approximately right angles so that this edge of the discharge opening away from the ships surface has a breakaway edge to prevent the flow of water discharged therefrom following the outer surface of the ship. The forward portions of cylindrical extension 12 and 13 merge smoothly from the outer surface of the ships hull to the outer edge of the respective discharge opening in order to minimize flow losses which may result from the projecting extension.

The discharge opening of each transverse passage is indicated at 17 and, as may be seen in FIG. 3 has an elliptical opening. The major axis of the elliptical opening is oriented with respect to the longitudinal axis of the ship. It has been found that the rudder force or steering effect obtained using an elliptical discharge
opening having an axis ratio of 1 to 0.7 at a ship's speed of 5.4 knots and a propulsion power rating of 500 h.p. is up to 170 per cent of the steering effect obtained with a circular discharge opening whose diameter is equal to the major diameter of the ellipse.

In FIG. 2 there is illustrated a modification of the present invention which is particularly intended for a ship which will not be steered with controlled streams of water when the ship is moving in the reverse direction. In such circumstances the forward edge of the projecting portion of the discharge opening does not require any extension of the discharge opening outwardly of the hull surface. The only portion of the transverse flow passage 5 which projects outwardly of the hull surface is the rearward edge of the discharge opening and this may be constructed as a lid or closure member 16 for the discharge opening 17. The closure member 16 may be pivotably mounted about a vertical axis 14 and pivoted by means of a hydraulic motor 15 through a suitable linkage. In this modification, the stream of water discharged from the transverse passage 5 is conducted away from the outer surface of the hull by the lid 16 which is positioned substantially perpendicular to the outer surface of the hull when opened. As a result, the force exerted on the ships hull by the discharged stream is fully effective and the steering effect or rudder force is not diminished.

In the modification of FIG. 3 which is illustrated as viewed in the direction p shown in FIG. 1 the discharge opening 17 is in the shape of a horizontal ellipse in which the ratio of minor to major axes is 3:4. In a manner similar to that illustrated in FIG. 2, the extension of the transverse discharge passage outwardly of the hull 2 is constructed as a closure member 16 adapted to shield the rearward portion of the discharge opening 5. The lid 16 is pivotally mounted on a hinge 18 mounted on the hull surface and is nonrotatable mounted on a spindle 19 so that the lid 16 can be pivoted by means of a hydraulic motor 15 acting on the spindle 19 by means of a lever 20 to close the discharge opening 17.

The steering device as described above may not only be mounted in the bow of the ship as illustrated in FIG. 1 but in any other portion of the ship which is below the water line. The steering device may also be installed in a horizontally extending bow bulge or bulg which is positioned below the water line and extends forwardly of the bow stem 10 shown in FIG. 1. Such a bulge essentially comprises a hollow cylindrical member having a rounded or approximately hemispherical cap on the forward end thereof. In such a construction the inlet opening of the longitudinal flow passage 7 is generally disposed in the center of the rounded forward end or vertically below the center. The transverse discharge ducts are then arranged in the cylindrical shell of the bulge at the level of the axis of rotation of the impeller or somewhat below this axis.

It is therefore apparent that the present invention provides for substantial rudder forces or a steering effect to be obtained by streams of water discharged outwardly of the ships hull even when the ship is travelling at a relatively high speed. At speeds of several knots the steering effect will be undiminished whereas in previously known constructions wherein the discharge opening of the transverse passage was flush with the hull surface no steering effect could be obtained.

It is understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within the invention as may fall within the scope of the appended claims.

What is claimed is:

1. In a steering device for a ship, the combination of a flow passage having one end opening on the surface of the hull at the bow of a ship, impeller means within said flow passage, first and second discharge passages branching from said flow passage behind said impeller means and having discharge openings on both sides of the hull, means comprising flaps mounted for pivotable movement within said discharge flow passages for controlling the flow of water therethrough, and means on said discharge passages for discharging water therewith outwardly of that portion of the hull surface rearwardly of each discharge opening, a wall of the rearward edge of a said discharge opening being at about a right angle to the hull surface.

2. In a steering device for a ship as claimed in claim 1 wherein the discharge opening is elliptical in shape.

3. In a steering device for a ship as claimed in claim 2 wherein the major axis of the elliptical opening is oriented with the longitudinal axis of the ship.

* * * * *