Y. WADAGAKI.

MARINE PROPULSION.

APPLICATION FILED JAN. 20, 1908.

899,359.

Patented Sept. 22, 1908.

2 SHEETS—SHEET 1.

FIG. 1

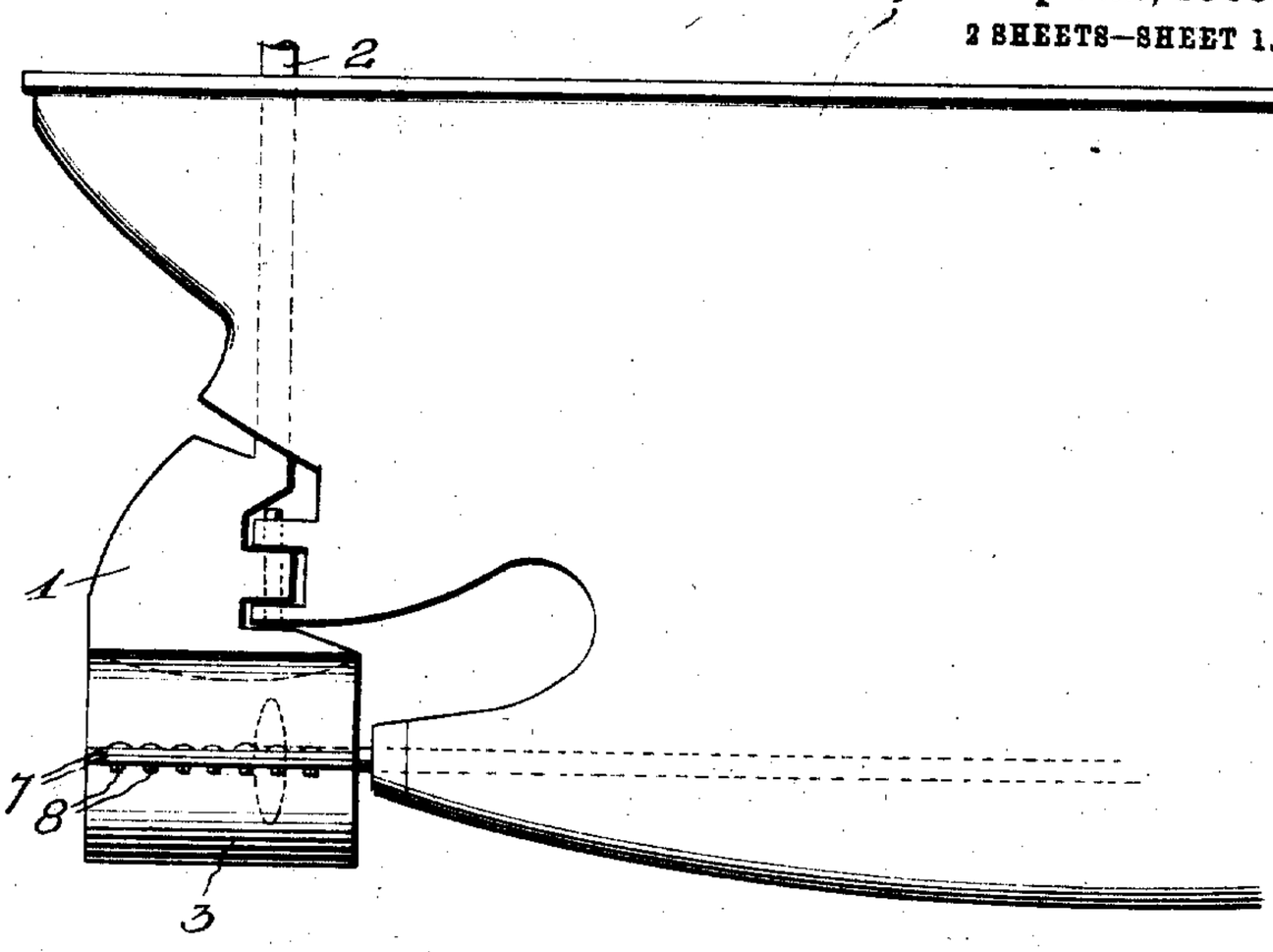


FIG. 6

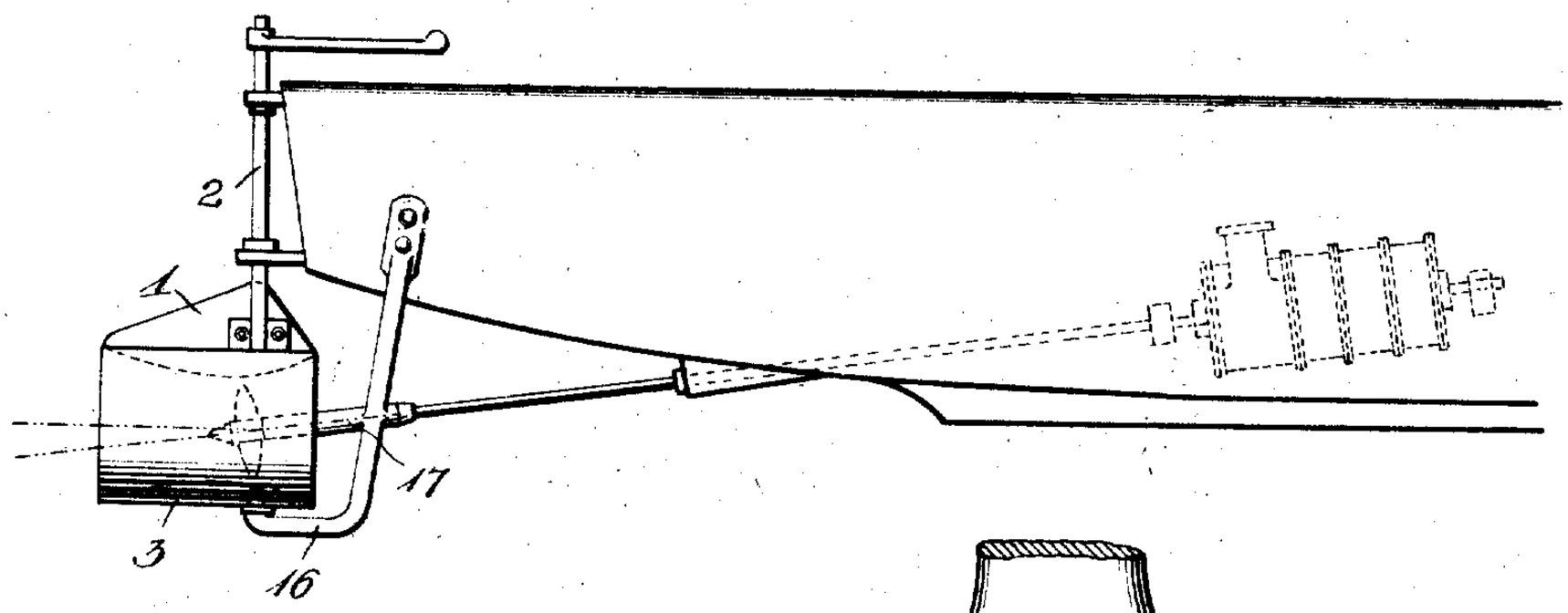
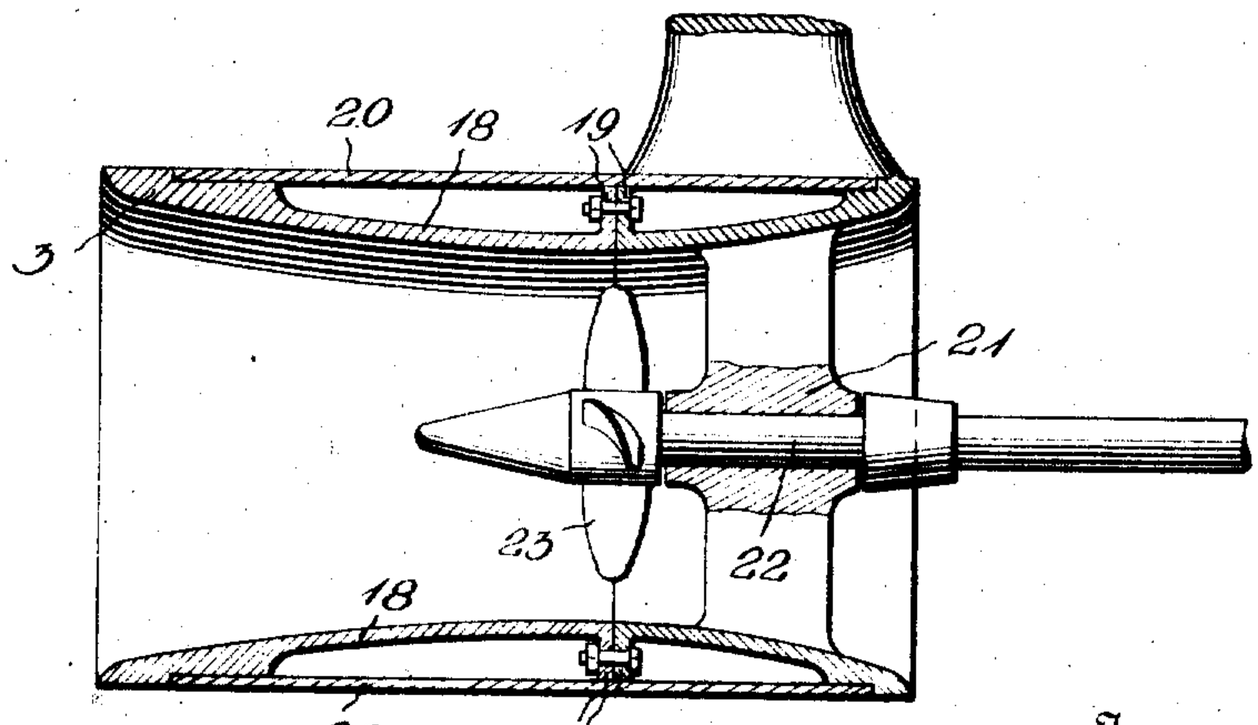


FIG. 7



Witnesses

L. O. Hilton

Inventor

Yasuzo Wadagaki

By A. Bloomfield & Co

Attorneys

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2 SHEETS—SHEET 2.

FIG. 4

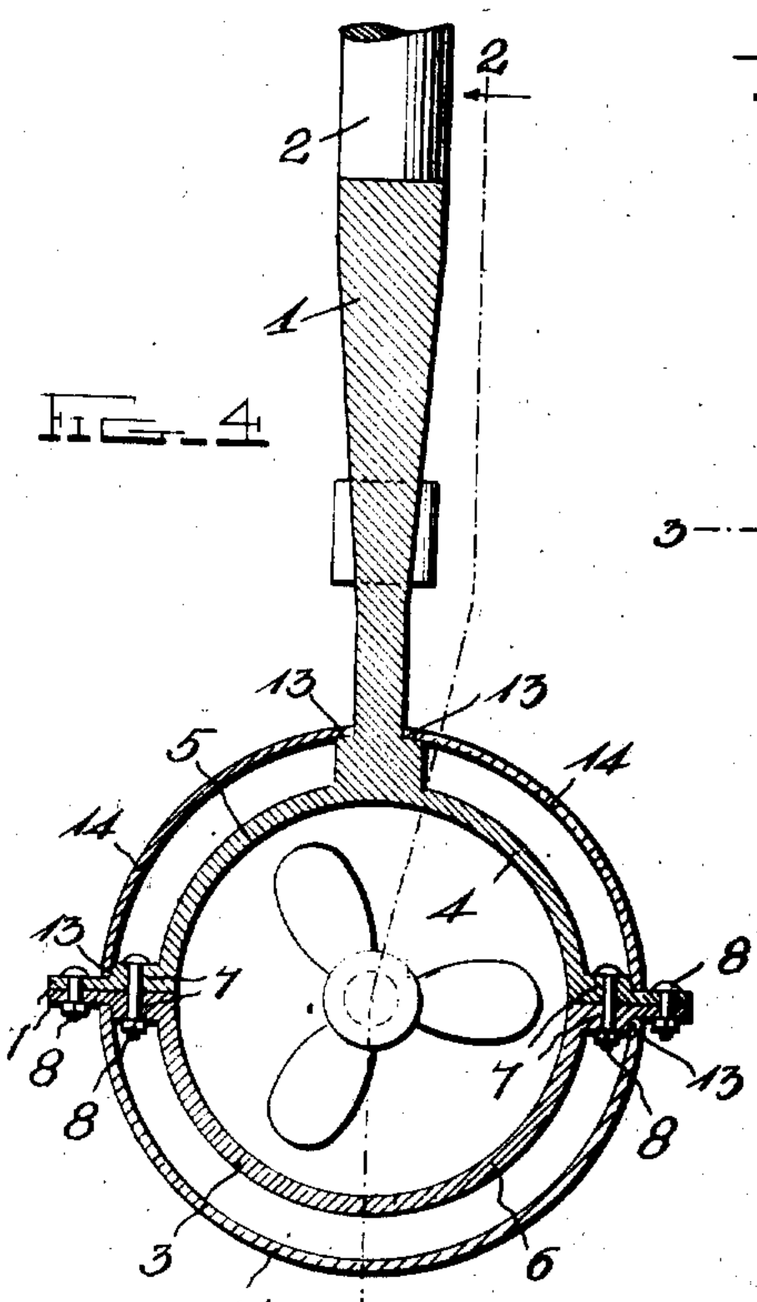


FIG. 2

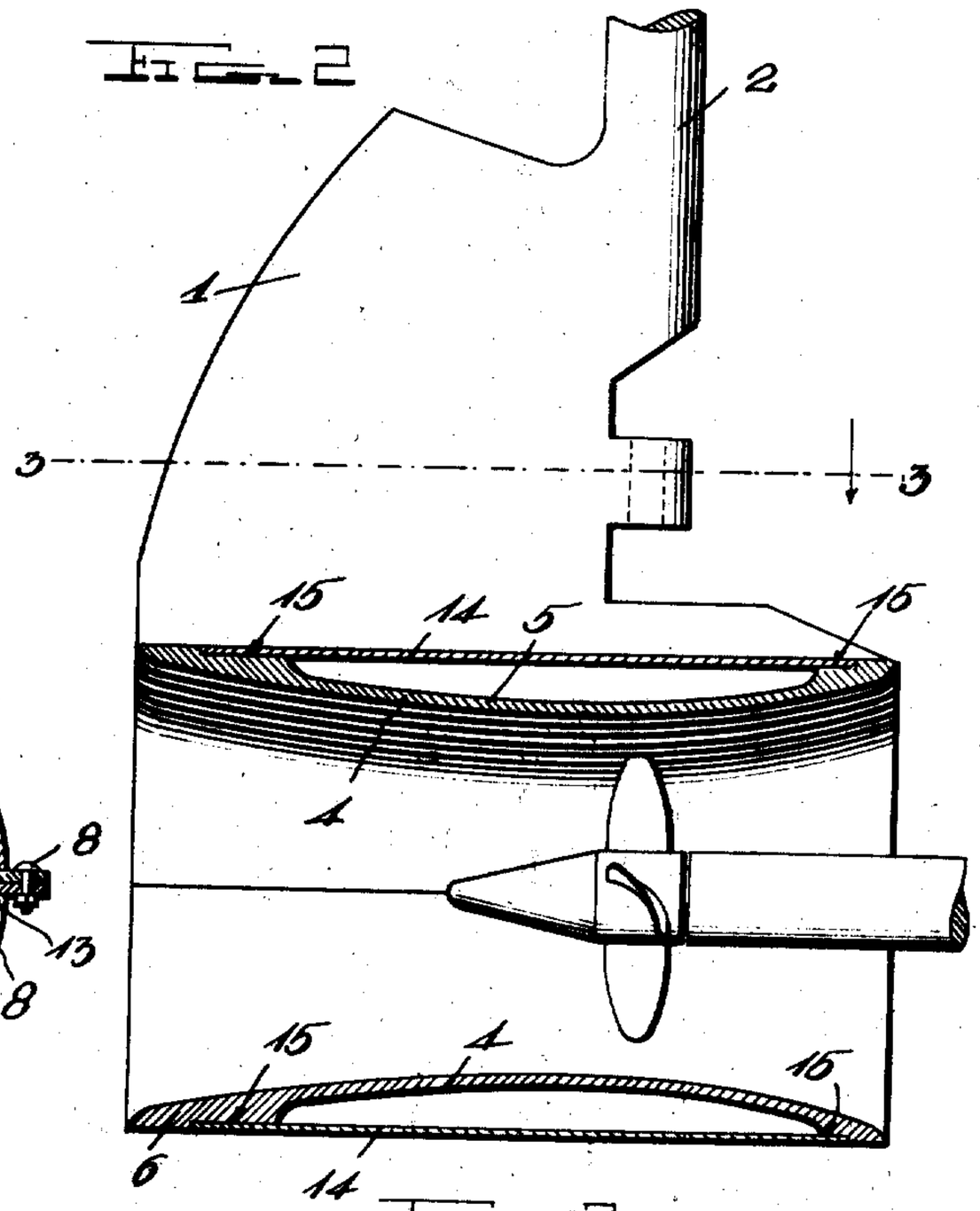


FIG. 5

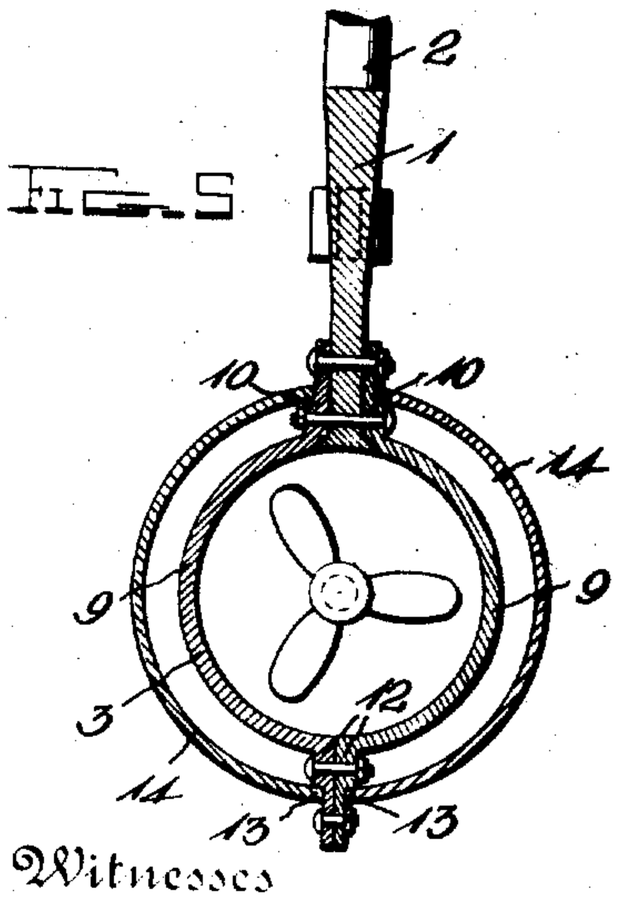
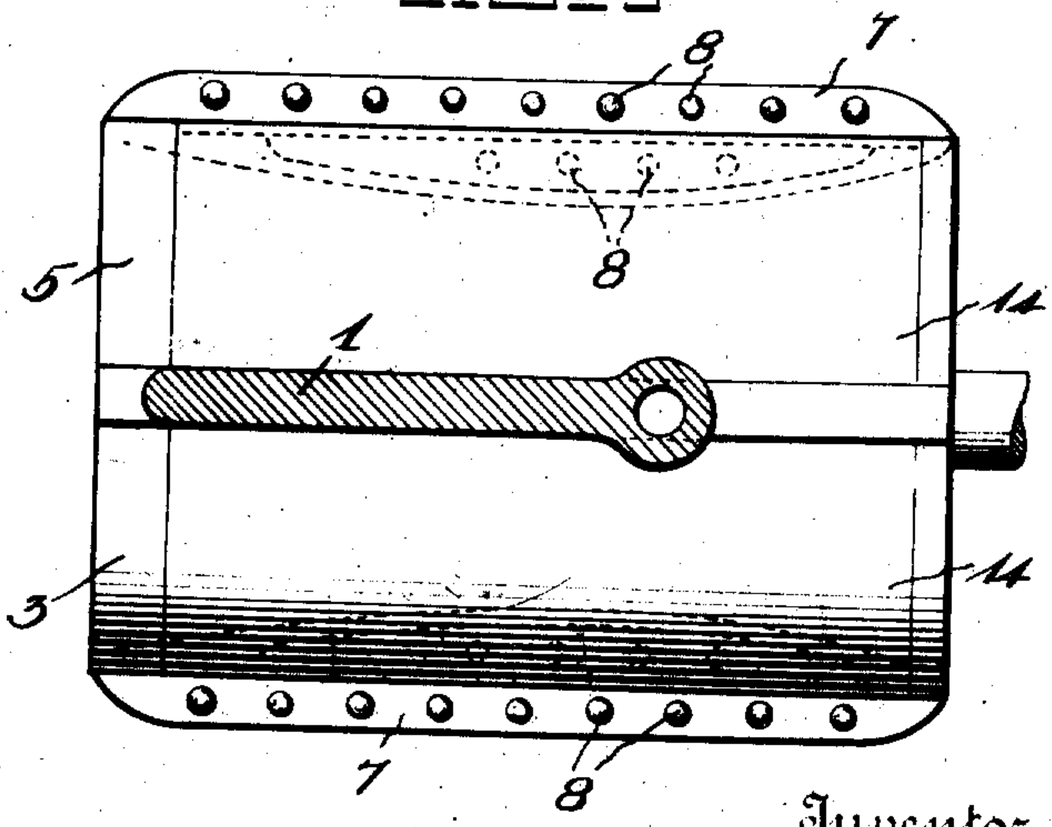


FIG. 3



Witnesses

L. O. Hilton

Inventor

Yasuzo Wadagaki

By A. Blwilson & Co

Attorneys

UNITED STATES PATENT OFFICE.

YASUZO WADAGAKI, OF SASEBO, JAPAN.

MARINE PROPULSION.

No. 899,359. Specification of Letters Patent. Patented Sept. 22, 1908.

Application filed January 20, 1908. Serial No. 411,668.

To all whom it may concern:

Be it known that I, YASUZO WADAGAKI, a subject of the Emperor of Japan, residing at Sasebo, in the Province of Hizen, Nagasaki Ken, Japan, have invented certain new and useful Improvements in Marine Propulsion; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in marine propulsion.

The object of the invention is to improve the construction of the propeller casing shown in United States Letters-Patent, No. 856,115, granted to me June 4, 1907, and to combine said casing with the rudder of a vessel.

Another object of the invention is to make the shape of the inlet end of the water channel within the propeller casing such that it will offer the least possible amount of resistance to the inflow of water.

Another object of the invention is to locate the point of maximum contraction of the water channel wherein the screw propeller operates as near to the inlet end of the casing as possible, and to make its discharge passage as long as possible with a view of obtaining a better utilization of the residual energy still contained in the mass of out-flowing water.

Another object of the invention is to make the angle of convergence of the discharge passage in the casing as small as possible and to gradually increase from a point of maximum contraction toward the after-end so as to allow the stream of out-going water to keep itself in close touch with the inside wall of the casing for as long a time as possible, and to thus avoid an unnecessary waste of power in the creation of eddies arising from the sudden enlargement of the sectional area of the stream.

Another object is to reduce the loss of useful thrust which may be occasioned by an excessive inclination of the propeller shaft from its usual fore-and-aft longitudinal direction.

A further object of the invention is to avoid the loss of useful thrust which may be caused by the interference of the rudder post on the action of the propeller race when the rudder is fitted in proximity to the screw propeller, and in the same vertical plane with the propeller shaft.

With these objects in view, the invention consists of certain novel features of construction, combination and arrangement of parts as will be described hereinafter and particularly pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a side elevation of the stern end of a vessel showing the application of the invention thereto; Fig. 2 is an enlarged sectional view of the propeller casing showing the position of the same on a rudder, and the position of the propeller within the casing; Fig. 3 is a horizontal sectional view through the rudder showing the casing in top plan view; Fig. 4 is a vertical sectional view through the rudder and the casing; Fig. 5 is a similar view showing a modified construction of the casing; Fig. 6 is a side elevation of a portion of a vessel showing the arrangement of the casing and the position of the propeller when the same is connected with and operated by a turbine of large diameter; and Fig. 7 is a vertical sectional view of a propeller casing embodying my improved construction, but formed and supported independently from the rudder.

Referring more particularly to the drawings, 1 denotes a rudder, the upper portion of which may be of the usual or any desired construction and is here shown as being formed integral with the lower end of the rudder post, 2. Secured to the lower edge of the rudder and forming a part of the same, is a tubular casing, 3, the outer surface of which is preferably cylindrical in form, as shown although in some cases it may be made slightly conical tapering aft. The casing, 3, is preferably formed in two sections, and is divided either longitudinally on a central horizontal plane, as shown in Fig. 4 of the drawings, or in a vertical longitudinal plane, as shown in Fig. 5 of the drawings, the sections of the casing being suitably bolted together, as shown. The inner wall of the casing flares outwardly toward its forward end to form an enlarged inlet opening for the passage of the water entering the same. From the point of the maximum contraction of the inner wall of the casing toward the rear or discharge end of the same, said inner wall diverges gradually, thus pro-

viding for the utilization of the residual energy still contained in the mass of outflowing water after being acted upon by the propeller blades. The flaring inlet end of the casing offers the least possible amount of resistance to the inflow of the water and provides for the admission of a large quantity of the latter which is sucked in from all forward directions by the flaring or bell-shaped mouth of the casing.

In the form of casing shown in Figs. 1 to 4, the inner wall, 4, is shown as being divided longitudinally in a horizontal plane on the line with the center of the casing, and forming an upper section, 5, which is formed integral with or suitably secured to the lower edge of the rudder, and a lower section, 6. The inner or meeting edges of the upper and lower sections, 5 and 6, of the casing, are provided with integrally formed laterally projecting flanges, 7, which are provided with alined bolt holes adapted to receive fastening bolts, 8, by means of which said sections are secured together.

In Fig. 5 of the drawings, the casing is shown as being divided longitudinally on a vertical plane in line with the center of the casing to form right and left-hand sections, 9, the inner or meeting edges of which are provided with laterally projecting upper and lower flanges, 10 and 12. The upper flanges, 10, are provided with bolt holes which are adapted to aline with similar holes formed in the lower edge of the rudder to which said upper flanges are adapted to be bolted, thus securely fastening the casing to the rudder. The lower flanges 12 are also provided with bolt holes through which are inserted fastening bolts by means of which the lower edges of the sections of the casing are secured together.

In both forms of the casing, the fastening flanges are provided with longitudinally disposed recesses, 13, in which are adapted to be secured the edges of substantially semi-cylindrical covering plates, 14, by means of which the annular channel around the casing formed by the inwardly curved wall, 4, is covered, and by means of which the outer surface of the casing presents a smooth cylindrical appearance. The outer ends of the semi-cylindrical plates, 14, are engaged with annular recesses, 15, formed in the outer surfaces of the sections of the inner wall 4, of the casing, as shown.

In Fig. 6 of the drawings, the casing is shown as applied to a vessel in the engine room of which is fitted a turbine of large diameter, which makes it necessary to set the propeller shafting at an excessive inclination from the direction of the vessel's progress. When the casing is used in connection with a propeller arranged in this manner, the center line of the casing may be set at a different angle to the inclination of the propeller shafting, and in a direction more nearly parallel to a horizontal plane or to the direction of the vessel's progress so as to recover a part of the energy lost by the obliquity of the propeller. In Fig. 6, the different directions of inclination or positions occupied by the propeller shaft and the casing are shown by dotted lines. In Fig. 6 the casing is shown as being supported by an arm 16, in which is formed an outer bearing, 17, for the propeller shaft.

In Fig. 7 is shown a sectional view of a casing constructed in accordance with the invention, but formed separately from and adapted to be supported on a vessel independently of the rudder. In the casing shown in this figure, the inner wall, 18, has the same curvature as described in connection with the casing shown in the former figures.

The inner wall, 18, as shown in Fig. 7 is divided transversely to form front and rear sections, the inner edges of which are provided with flanges, 19, adapted to be bolted together, as shown. The inner wall is provided with an outer cylindrical cover plate, 20, and in the forward section of the inner wall is formed a bearing, 21, for the shaft, 22, of the propeller, 23, which is operatively mounted in the casing at the point of the greatest contraction of the inner wall.

In the operation of my improved casing, the water is sucked readily into the inlet end of the same from all forward directions in the shape of an inverted cone, so that a large quantity of water is permitted to enter with the least possible resistance. It will be noted that the length required for the inlet passage of water at the forward end of the propeller casing is much shorter in the present case, than that shown and described in my patent hereinbefore mentioned.

In passing through the most contracted part of the casing, the water finds itself brought to a gradually expanding part of the channel in the after-body of the casing, with its velocity correspondingly reduced in nearly the same manner as in my previous patent, but in the form shown herein, a much better opportunity is presented to recover for useful purpose the kinetic energy of the water in the tail-race of the propeller, as the discharge passage of the casing is as much lengthened in proportion as the inlet end has been shortened.

In my previous system of marine propulsion as described in my former patent, the discharge passage of the water channel was formed with a double curvature, but in the present system this is done with a single easy curve. This fact, combined with the increased length of the discharge passage that is obtained in the manner hereinbefore described, makes it possible to avoid the sudden enlargement of sectional area and the

consequent abrupt change of direction in the flow of the water particles, which is always a serious cause of inefficiency.

In certain cases of screw propellers, the length of stroke required for the engine or the large diameter of the turbine, as shown in Fig. 6, makes it necessary to set the center line of the propeller shaft at a considerable inclination from the direction of the vessel's progress. With an ordinary screw propeller under such circumstances, the loss of useful thrust would evidently become very serious. With my system of screw propeller, however, the center line of the propeller casing can always be fitted in any desired direction, quite irrespective to the direction of the screw shafting, so that a part of the energy lost by any excessive inclination of the propeller shaft will always be recovered by fixing the propeller casing in a suitable direction.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters-Patent, is:

1. A propeller casing formed in longitudinal sections, the inner walls of which are formed to provide a short converging channel at the forward end of the casing, and a long gradually diverging channel in the rear portion of the casing wherein a screw propeller is arranged to operate at the point of maximum contraction of said convergent and divergent water channel, substantially as described.

2. A ship's rudder having formed on its lower edge a cylindrical casing, the inner wall of which is curved to form a short outwardly flaring passage at the inlet end of the casing, and a long gradually outwardly flaring or diverging rear portion opening at the rear or discharge end of the casing, substantially as described.

3. In combination with a ship's rudder, a casing formed in longitudinal sections, one of which is arranged on the lower edge of the rudder, laterally projecting flanges formed on the meeting edges of said sections, fastening bolts adapted to secure said sections together, an inwardly curved inner wall formed in said sections to provide a convergent and divergent water channel, and outer segmental covering plates adapted to be arranged around said inner wall to provide a cylindrical outer surface for said casing, substantially as described.

4. In a system of marine propulsion, a propeller casing having an inner wall formed to provide a short outwardly flaring passage at the inlet end of the casing, and a long gradually tapered outwardly flaring or diverging passage at the discharge end of the casing, a propeller operatively arranged in said casing at the point of maximum contraction of said passage, and means whereby said casing is supported at an angle to the direction of the propeller shaft, thereby providing for a partial recovery of energy which would otherwise be lost by an excessive inclination of the propeller shaft.

5. In a system of marine propulsion, a rudder, a propeller casing adapted to form part of said rudder, an inner curved wall arranged in said casing to form a passage having a short convergent forward end and a long gradually diverging rear passage, and a propeller operatively arranged in said casing at the point of maximum contraction of said channel, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

YASUZO WADAGAKI.

Witnesses:
CARLETON MILLER,
TSUNEZO SHIGIO.