

PATENT SPECIFICATION

(11) 1 404 508

1 404 508

- (21) Application No. 4444/74 (22) Filed 31 Jan. 1974
 (61) Patent of Addition to No. 1 378 120 dated 5 April 1973
 (31) Convention Application No. 2 315 447
 (32) Filed 28 March 1973 in
 (33) Germany (DT)
 (44) Complete Specification published 28 Aug. 1975
 (51) INT CL² B63H 25/46, 11/10
 (52) Index at acceptance B7V 52 53B



(54) A PROPULSION SYSTEM FOR PROPULSION AND STEERING OF A WATERBORNE CRAFT

(71) We, SCHOTTEL-WERFT JOSEF BECKER KG, of 5401, Spay/Rhein, Germany, a German Body Corporate, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a propulsion system for propulsion and steering of a waterborne craft, and is an improvement in or modification of the invention described in the complete specification of Patent Application No. 16390/73 (Serial No. 1,378,120), referred to below as the parent specification.

The parent specification describes and claims a water jet propulsion system arranged for propulsion and steering of a waterborne craft having an inboard motor, the propulsion system comprising a curved elbow-duct accommodated within a recess in the hull of the craft so as not to project beyond the bottom of the craft, the elbow duct having a substantially horizontally directed outlet end and an inlet end directed downwardly and substantially vertically, the elbow-duct being swivellable around a substantially vertical axis, the downwardly directed part of the elbow-duct containing a propeller or propellers having a substantially vertical axis of rotation and being drivable by the motor in order to draw water upwards into the inlet end of the elbow-duct and to expel the water substantially horizontally from the outlet end.

The present invention aims to make this propulsion system suitable for extremely shallow draft, where satisfactory efficiency of the propulsion system should be assured. Satisfactory efficiency implies, *inter alia*, that air should not be drawn in, as far as possible. The system should be so constructed that it may be installed at the bottom of the waterborne craft.

In accordance with the present invention, the propulsion system includes a water

deflecting means which surrounds the elbow duct and directs the water jet from the outlet end of the elbow duct outwards and downwards of the craft whatever the angular position of the elbow duct.

The curved section of the elbow duct may appropriately be constructed in the form of a flow-promoting nozzle. The propeller pump is preferably installed in the curved elbow duct in such a way as to result in a small suction head. The curved elbow duct or nozzle is advantageously equipped with guide vanes. Since the waterjet is directed downwards at an angle, the propulsion system may be installed at practically any optional point in the bottom of the waterborne craft. The invention is not limited to a downwardly angled direction of discharge, and the water jet may emerge horizontally in some or all positions of the elbow duct, depending on the position of the propulsion system in the waterborne craft and depending on its size or on the size and shape of the waterborne craft.

The water jet propulsion system in accordance with the invention should be appropriate to be installed in the keel of the waterborne craft; for this reason, the guiding system can have the features defined in claim 2 or 3.

An engine for driving the propeller(s) may be mounted separately within the hull of the waterborne craft, or it may be mounted on a casing of the propulsion system, with which it may for example form a complete unit. The same goes for a steering drive system for the curved elbow duct.

The invention will be described further, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 diagrammatically shows a cross-section of a water jet propulsion system in a waterborne craft;

Figure 2 is a section taken on line II—II in Figure 1;

Figure 3 is a plan view of the water jet propulsion system seen in the direction of

the arrow III in Figure 1;

Figure 4 is similar to Figure 1 and shows another embodiment of propulsion system;

Figure 5 is a section at right angles to that of Figure 4; and

Figure 6 is a plan view of the system shown in Figures 4 and 5.

Figure 1 shows the stern of a waterborne craft 1 which has a very shallow draft — from the water level 2 to its keel line or bottom 3 so that it cannot be propelled by means of a conventional propeller; also, a steering propeller making use of adjustable depth setting could be used only if the depth of the waterway travelled were adequate. So that it may also be possible to travel over very shallow waterways, the propulsion system shown has been incorporated. This comprises a nozzle-like elbow duct 4 wherein a propeller pump 5 having a vertical shaft is installed. The elbow duct 4 deflects the water drawn in vertically by the propeller pump into a substantially horizontal direction. So that the suction head of the propeller pump may be small, the propeller (or the lowest propeller if there are several) constituting the pump 5 is situated closely above the suction aperture of the elbow duct. The lower edge of the elbow duct is situated approximately at the bottom of the waterborne craft. To increase the efficiency of the elbow duct, it is equipped with one or more guide vanes 6.

So that the waterborne craft 1 may not only be propelled but also steered by means of the thrust generated by the propeller pump situated within the elbow duct 4, the elbow duct is arranged to be swivellable around a vertical axis which appropriately coincides with the axis of the propeller pump 5. The elbow duct 4 thus transmits to the craft 1 a thrust in a direction opposite to the discharge direction of the elbow duct.

The propeller pump 5 is driven by an engine 7, through a clutch or coupling 8, a transmission shaft 9, and an angle drive 10. If need be, a speed change and/or reversing gear may be incorporated in this power transmission system. The angle drive 10 may, for example, be a worm drive or a bevel gear drive, whose output member is situated on the driving shaft of the propeller pump 5. If need be, the transmission shaft may be constructed with a universal joint or Cardan shaft. A motor 11, for example an electric or hydraulic motor, drives a shaft 13 of the elbow duct 4 for the purpose of swivelling displacement. The elbow duct 4 is journaled in a base plate 14 which is fastened within the waterborne craft 1. This base plate is situated above the elbow duct. A second bearing (not shown), which is situated approximately at the level of the bottom of the waterborne craft, may be incorporated complementarily for the elbow

duct and the propeller pump.

A bell-shaped fairing 15 is adjacent to the base plate 14. A bell-shaped or umbrella-shaped cone 16 is at a distance below the fairing 15 substantially equal to the height of the discharge aperture of the elbow duct. The fairing 15 and cone 16 are held spaced apart by means of vertical guide vanes 17. The fairing and cone together form an annular discharge aperture 18 in the bottom 3 of the waterborne craft 1. The annular discharge opening is dimensioned in accordance with the emergent water flow. The case consisting of the fairing 15, cone 16, and guide vanes 17 is so formed that the water jet ejected approximately horizontally from the discharge aperture of the elbow duct 4 is deflected obliquely downwards as shown by the arrows 19. This case therefore constitutes a guiding system for the water jet from the duct 4, whatever the position of the duct 4.

If the waterborne craft has a horizontal bottom 3, as shown in Figure 2, then the case (15, 16, 17) also has a substantially horizontal base surface, which contains the annular discharge aperture. The case constituting the guiding system may alternatively be so formed that the flow of water is ejected horizontally, if the waterborne craft is of a shape appropriate for this.

In the propulsion system illustrated in Figures 1 to 3, the motor 7 for the propeller pump is shown installed within the waterborne craft 1, and the duct-swivelling motor 11 is mounted on the base plate. Other appropriate arrangements may be devised: for example, the motor for the propeller pump may also be mounted on the base plate and may be co-axial with the propeller or propellers.

Figures 4 to 6 show a propulsion system installed in a waterborne craft 21 whose bottom 22 slants towards a keel 24. The water level 23 is again situated very closely above the keel 24 of the waterborne craft, i.e. it has a very shallow draft. The arrangement of the elbow duct, the propeller pump, and the propulsion systems is basically as described with reference to Figures 1 to 3. Once again, a fairing 25 paired with a cone 26 are incorporated. One modification is that the cone 26 has a greater radial extension, so that the emergent water is guided further beyond the outlet of the elbow duct, thereby reliably preventing penetration of air into the propeller zone. The fairing 25 and cone 26 are held spaced apart (by a distance which decreases with radial distance from the elbow duct) by guide plates or guide vanes 27, this assembly constituting a guiding system, as before. Spacing tubes 28 are incorporated for radial support of both parts. Since the fairing 25 is

substantially conical, whereas the bottom of the waterborne craft slopes downwards towards its keel, the discharge aperture 29 of the fairing 25 is an oval whose area is dimensioned to correspond to the outflowing quantity of water.

One or more propulsion systems as described may be incorporated in the waterborne craft. It is appropriate to have a propulsion system which may be produced as a complete structural unit, the unit being stored and installed as such in the waterborne craft.

The elbow duct will normally be rotatable about its vertical axis through at least 360°. If there are special reasons, it may be limited to turn through a smaller angle. The vertical guide vanes 17 or 27 merely represent an example, and they may therefore be constructed in other forms according to requirements, e.g. the guide vanes may extend downwards to the discharge aperture.

WHAT WE CLAIM IS:—

1. A water jet propulsion system arranged for propulsion and steering of a waterborne craft having an inboard motor, the propulsion system comprising a curved elbow-duct accommodated within a recess in the hull of the craft so as not to project beyond the bottom of the craft, the elbow duct having a substantially horizontally directed outlet end and an inlet end directed downwardly and substantially vertically, the elbow duct being swivellable around a substantially vertical axis, the downwardly directed part of the elbow-duct containing a propeller or propellers having a sub-

stantially vertical axis of rotation and being drivable by the motor in order to draw water upwards into the inlet end of the elbow duct and to expel the water substantially horizontally from the outlet end, the propulsion system including a water deflecting means which surrounds the elbow duct and directs the water jet from the outlet end of the elbow duct outwards and downwards of the craft whatever the angular position of the elbow duct.

2. A propulsion system as claimed in claim 1, in which the water deflecting means comprises a fairing which opens out downwardly.

3. A propulsion system as claimed in claim 1, in which the water deflecting means comprises a casing having upper and lower walls which slope downwardly and outwards away from the elbow duct.

4. A propulsion system as claimed in claim 3, in which the vertical distance between the said walls decreases with increasing radial distance from the elbow duct.

5. A propulsion system as claimed in any of claims 1 to 4, in which the water deflecting means includes vertical guide vanes extending outwards with respect to the elbow duct.

6. A propulsion system arranged for propulsion and steering of a waterborne craft, substantially as described herein with reference to and as shown in Figures 1 to 3 or Figures 4 to 6 of the accompanying drawings.

MARKS & CLERK.



substantially conical, whereas the bottom of the waterborne craft slopes downwards towards its keel, the discharge aperture 29 of the fairing 25 is an oval whose area is dimensioned to correspond to the outflowing quantity of water.

One or more propulsion systems as described may be incorporated in the waterborne craft. It is appropriate to have a propulsion system which may be produced as a complete structural unit, the unit being stored and installed as such in the waterborne craft.

The elbow duct will normally be rotatable about its vertical axis through at least 360°C. If there are special reasons, it may be limited to turn through a smaller angle. The vertical guide vanes 17 or 27 merely represent an example, and they may therefore be constructed in other forms according to requirements, e.g. the guide vanes may extend downwards to the discharge aperture.

WHAT WE CLAIM IS:—

1. A water jet propulsion system arranged for propulsion and steering of a waterborne craft having an inboard motor, the propulsion system comprising a curved elbow-duct accommodated within a recess in the hull of the craft so as not to project beyond the bottom of the craft, the elbow duct having a substantially horizontally directed outlet end and an inlet end directed downwardly and substantially vertically, the elbow duct being swivellable around a substantially vertical axis, the downwardly directed part of the elbow-duct containing a propeller or propellers having a sub-

stantially vertical axis of rotation and being drivable by the motor in order to draw water upwards into the inlet end of the elbow duct and to expel the water substantially horizontally from the outlet end, the propulsion system including a water deflecting means which surrounds the elbow duct and directs the water jet from the outlet end of the elbow duct outwards and downwards of the craft whatever the angular position of the elbow duct.

2. A propulsion system as claimed in claim 1, in which the water deflecting means comprises a fairing which opens out downwardly.

3. A propulsion system as claimed in claim 1, in which the water deflecting means comprises a casing having upper and lower walls which slope downwardly and outwards away from the elbow duct.

4. A propulsion system as claimed in claim 3, in which the vertical distance between the said walls decreases with increasing radial distance from the elbow duct.

5. A propulsion system as claimed in any of claims 1 to 4, in which the water deflecting means includes vertical guide vanes extending outwards with respect to the elbow duct.

6. A propulsion system arranged for propulsion and steering of a waterborne craft, substantially as described herein with reference to and as shown in Figures 1 to 3 or Figures 4 to 6 of the accompanying drawings.

MARKS & CLERK.