Ship Provided With At Least One Shaft Line Equipped With A Helical Pump Propeller

The present invention relates to a ship, especially a passenger ship, which is provided with at least one shaft line equipped with a propeller consisting of a sub-nozzle helix fitted with a stator, the whole being called "helical pump" hereinbelow and described more precisely hereinbelow.

The use of a helical pump as propeller in a propulsion installation of a ship has multiple advantages.

In fact, the installation is mechanically simple relative to other propulsion systems used, especially for liners, such as "pods", and provides high-output thrust with a minimum of acoustic noise and vibration.

A helical pump generally comprises a stator (constituted by several flow-directing fins), a rotor (in this case a helix) and a nozzle enclosing the assembly.

The forms of the nozzle, the vanes of the rotor and of the stator are designed as is known to get the best output and attain a given speed with the lowest possible mechanical power.

The helical pump is connected to the ship by means of a shaft line which drives the rotor in rotation. This drive can be accomplished by any type of known process (by crank, enclosed electric motor, etc.).

When it is operating, the stator, generally located upstream of the rotor, communicates a rotational component to the flow about the axis of the nozzle in a direction of rotation opposite the direction of rotation of the rotor. Generating this rotation creates hydrodynamic torque on the stator via reaction.

This arrangement aims to compensate the rotational effect caused by the rotor on the fluid and improve output of the installation. In an optimised design, torque on the stator is equal and opposite the torque on the rotor, the result of which is to cancel the quantity of angular movement in the wake of the propeller assembly.

Also, *criteria for distancing the propeller relative to the hull of the ship are* used to reduce interactions between the hull and the hull.

Embodiments~~The aim~~ of the present invention seek~~is~~ to further improve the propulsive output of a helical pump on board a ship; ~~the aim~~ more particularly ~~is~~, to provide~~propose~~

a hydrodynamic hull form for optimising the overall propulsive output of a ship propelled by one or more helical pumps.

An aspect of~~In this way,~~ the present invention provides~~proposes~~ a ship, especially a passenger ship, which is provided with at least one shaft line equipped with a propeller consisting of a helical pump comprising a rotor, one or more stators and a nozzle, characterised in that its hull has, substantially opposite said helical pump, a concave form and the curve delimiting this concave form, according to a longitudinal and vertical cut plane passing through the axis~~centre~~ of rotation of the rotor, has two points of inflexion, one located upstream and the other downstream of said helical pump, and a tangent parallel to the axis of the shaft line, said~~a~~ tangent located upstream of said helical pump.

According to other advantageous and non-limiting characteristics of this ship:

- said tangent upstream of said helical pump is located at an axial distance L from the leading edge of the nozzle, this distance being less than D/4, D being the diameter of said rotor;
- said hull is distant from said nozzle by a constant gap, according to a direction perpendicular to the axis of said shaft line;
- the median longitudinal plane of the ship constitutes a plane of symmetry of said hull, this plane passing through the thin plane of the ship;
- in a horizontal plane, and/or in intermediate planes located between the vertical plane and said horizontal plane and passing through the axis of the shaft line, substantially opposite the helical pump the surface of said thin plane has a concave form and the curve delimiting this concave form, according to this horizontal and/or intermediate plane passing through the axis of rotation of the rotor has two points of inflexion, one located upstream and the other downstream of said helical pump, and a tangent parallel to the axis of the shaft line, a tangent located upstream of said helical pump.
- the distance H1 between the axis of the shaft line and said hull, measured perpendicularly to the axis of the shaft line and at said distance L from said leading edge of the nozzle is greater than the distance H2 between the axis of the shaft line and said hull,

CLAIMS

1. A ship, especially a passenger ship, which is provided with at least one shaft line (3) equipped with a propeller consisting of a helical pump (4) comprising a rotor (42), one or more stators (40) and a nozzle (41), characterised in that its hull (2) has, substantially opposite said helical pump (4), a concave form (C) and the curve (I) delimiting this concave form, according to a cut plane longitudinal and vertical (I-I) passing through the axis of rotation of the rotor (42), has two points of inflexion (PI1, PI2), one (PI1) located upstream and the other (PI2) downstream of said helical pump (4), and a tangent (T) parallel to the axis (X-X') of the shaft line (3), said tangent located upstream of said helical pump (4).

2. The ship according to Claim 1, characterised in that said tangent upstream of said helical pump (4) is located at an axial distance (L) from the leading edge (410) of the nozzle (4), this distance being less than D/4, D being the diameter of said rotor (42).

3. The ship according to Claim 1 or 2, characterised in that said hull (2) is distant from said nozzle (41) by a constant gap (G), according to a direction perpendicular to the axis (X-X') of said shaft line (3).

4. The ship according to any one of Claims 1 to 3, which comprises two parallel shaft lines (3), characterised in that the median longitudinal plane (P) of said hull (2) constitutes a plane of symmetry for said helical pumps (4), this plane passing through the thin plane (PM) of the ship.

5. The ship according to Claim 4, characterised in that the surface of said thin plane (PM) has, in a horizontal plane (HO) and/or in intermediate planes (IN) located between the vertical plane (I, I) and said horizontal plane (HO) and passing through the axis (X-X') of the shaft line, substantially opposite the helical pump (4), a concave form (C) and the curve (I) delimiting this concave form according to this horizontal (HO) and/or intermediate (IN) plane passing through the axis of rotation of the rotor (42) has two points of inflexion (PI1, PI2), one (PI1) located upstream and the other (PI2) downstream of said helical pump (4),

and a tangent (T) parallel to the axis (X-X') of the shaft line (3), said tangent located upstream of said helical pump (4).

6. The ship according to any one of Claims 1 to 4, characterised in that the distance (H1) between the axis (X-X') of the shaft line (3) and said hull (2), measured perpendicularly to the axis (X-X') of the shaft line (3) and at said distance (L) from said leading edge (410) of the nozzle (41), is greater than the distance (H2) between the axis (X-X') of the shaft line (3) and said hull (2), measured perpendicularly to the axis (X-X') of the shaft line (3) and the trailing edge of the nozzle (41).

7. The ship according to any one of Claims 3 to 6, characterised in that, in a cut plane (II-II) transversal and vertical to said nozzle (31), said hull (2) is distant from said nozzle (31) by said constant gap (G) over an angular sector by at least 45°.