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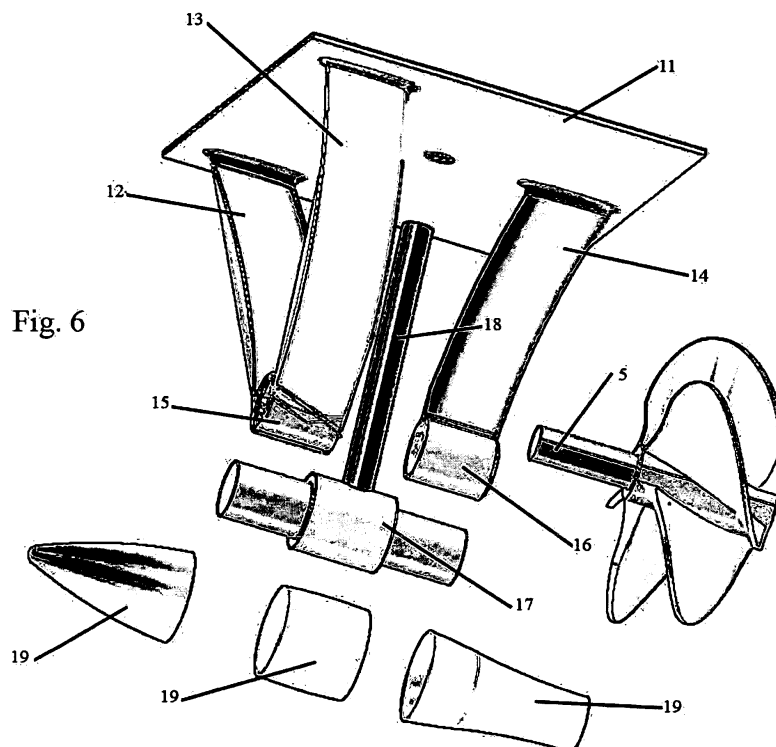
(54) Stern drive, in particular for twin-propeller boats

(57) The invention relates to a stern-drive unit for boats with an inclined hull.

In the drive according to the invention, the mechanical units are separated from the supporting structure, which is made in the form of a structure (10) supporting parts (7, 5) which transmit motion from an inverter (6), located at the output of engine (3), to the propeller, consisting a plate (11) designed to be attached to the keel of the boat, to which are connected a pair of V-shaped arms with a

first sleeve (15) fitted at the lower ends thereof, and a third arm with a second sleeve (16) fitted at the lower end thereof, which said sleeves (15, 16) house a box (17) to which lead propeller shaft (5) and a shaft (7) orthogonal to it, leading from a motion inverter, seal means being fitted between said box (17) and said shafts (5, 7).

The result is a light drive which is easily adaptable at low cost to the various keel configurations used by different boat builders.



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Description

[0001] The invention relates to a stern-drive unit for boats, which is designed to be fitted to boats with an inclined hull.

[0002] In the drive according to the invention, the mechanical units are separated from the supporting structure, which is made in the form of a number of arms integral with a plate fixed to the keel of the boat; said arms carry bushings or sleeves that support the mechanical units, which are covered by a shell designed to enhance the hydrodynamics of the system.

[0003] The result is a light drive which is easily adaptable at low cost to the various keel configurations used by different boat builders.

[0004] One of the main problems encountered by boat designers is how to exploit the small amount of available space to the full, and minimise the weight of the mechanical parts of the boat.

[0005] In the field of systems for the transmission of motion to the propellers, which are one of the parts of the boat in which these problems are most acute, an interesting solution, which is the most advantageous in terms of size, is the one that uses a "stern drive".

[0006] This is a drive unit wherein the motion output from the engine is transmitted to a substantially vertical shaft which, via a further transmission, rotates the propeller shaft, which is generally inclined by a few degrees from the horizontal plane.

[0007] This known configuration provides the greatest space saving, but it is impractical, because a motion inverter unit has to be associated with the transmission device; the overall cost is very high, with the result that this system is uncompetitive, and there is no demand for it.

[0008] This problem was solved by the present applicant with a drive unit forming the subject of patent application PC 2002 A 027, which comprises (i) a transmission with two coaxial bevel gears, fitted opposite one another on the same engine shaft, which engage a bevel gear mounted on a shaft orthogonal to the preceding one, and (ii) means designed to make one or other of said bevel gears integral with said engine shaft, in order to control the rotation of the shaft leading to the propellers in one direction or the opposite direction.

[0009] However, the considerable advantages offered by this solution are limited by the need to adapt the supporting structure of the mechanical parts in this type of drive to the keel configuration, which varies from one boat builder to another.

[0010] In order to understand the problem, reference should be made to the schematic drawing in figure 1, which shows a boat keel in cross-section along a plane orthogonal to the boat axis, and figure 2, which shows a stern drive of known type.

[0011] In the figures, no. 1 indicates the keel of a boat with a V-shaped hull and slanting walls. No. 2 indicates the stiffening structures of the boat, which are arranged

longitudinally, with engine unit 3 mounted on them.

[0012] Engine output shaft 4 is connected to propeller shaft 5 via a drive which, in known solutions, comprises a motion inverter 6 and a vertical shaft 7, which in turn is connected to propeller shaft 5 via a bevel gear pair or other known system.

[0013] In these known drives, the parts downstream of the inverter are housed in a casing 8 made of metal of suitable thickness (approx. 20-30 mm), integral with a plate 9 used to secure the whole assembly to the boat.

[0014] Said casing has a considerable weight, of several hundred kilos, which it would be useful to reduce as far as possible.

[0015] This structure, as well as being very heavy, is very expensive if a single specimen or a small production run is made, because the cost of the moulds used to make the casing will be spread between a very small number of parts.

[0016] Figure 1 shows two possible embodiments of the casing.

[0017] In the casing shown on the left-hand side of the figure, plate 10 is inclined in relation to the body which encloses shaft 7, at an angle equal to the angle α formed between the bottom wall of the boat and the horizontal plane.

[0018] The axis of shaft 7 intersects with the axis of engine shaft 4, which is the ideal solution in kinematic terms, because it enables motion to be transmitted between the two shafts via a simple bevel gear pair. However, that solution requires a different casing to be made for each type of boat, to adapt the assembly to the specific keel configuration.

[0019] Conversely, the configuration of the casing shown on the right-hand side of the same figure is easily applicable to boats with differently inclined hulls, because plate 9 is substantially orthogonal to the body that contains shaft 7. However, as the axis of shaft 7 does not intersect with engine shaft 4, but passes at a distance "d" from it, depending on the geometry of the assembly, further parts are required to transmit motion between the two shafts, and the torque created discharges considerable forces onto the structure, which must be absorbed by suitably strengthening the structure.

[0020] These problems are now solved by the present invention, which relates to a stern-drive unit wherein the mechanical parts are separated from the supporting structure, which can thus be easily made with a configuration adaptable to the type of boat in question without excessively onerous modifications.

[0021] Basically, in the unit according to the invention, the casing consists of a plate to which are fixed two V-shaped arms which terminate with a sleeve, and a third straight central arm, which also terminates with a sleeve, aligned with the preceding one.

[0022] The mechanical parts are made in the form of separate units, which are assembled and mounted on said sleeves, and the whole assembly is completed by a fairing made of fibreglass or other light, low-cost material.

[0023] The fact that the structure is made in the form of a plate to which three arms are fixed means that modifications are very easily made, so that the structure can be adapted to different boat configurations with little work, and no need for complex, expensive operations.

[0024] The invention will now be described in detail, by way of example but not of limitation, by reference to the annexed figures wherein:

- figures 1 and 2 schematically illustrate a cross-section of a boat and a view of a drive unit made according to the prior art;
- figure 3 is a schematic side view of a drive unit according to the invention;
- figures 4 and 5 are perspective views, from below, of a drive unit according to the invention;
- figure 6 is an exploded perspective view of the unit.

[0025] As shown in figures 4 and 6, the drive unit according to the invention comprises a supporting structure 10, on which are mounted the various parts that transmit motion from inverter 6 to the propeller.

[0026] In greater detail, said supporting structure comprises a plate 11 designed to be fixed to the structure of the boat in accordance with a known technology, to which three arms, 12, 13 and 14, are welded or otherwise secured.

[0027] The first two of said arms, 12 and 13, are located in the front part of the plate and arranged in a V shape; the upper ends are at a distance from one another and welded to the plate, while the lower ends converge and are welded to a bushing or sleeve 15, coaxial with propeller shaft 5.

[0028] The third shaft 14 is located in the rear part of plate 11, in a central position, and supports a second sleeve 16, coaxial with the preceding one, at the lower end.

[0029] Propeller shaft 5 and vertical shaft 7, which is orthogonal to it, lead to a box 17, which is supported by sleeves 15 and 16.

[0030] Shaft 7 passes into a cylindrical body or box 18, and the two shafts 5 and 7 are connected via an angular transmission of known type not illustrated in the figure.

[0031] Seal elements, also of known type, are inserted between shafts 5 and 7 and their respective boxes.

[0032] The structure is preferably, but not necessarily, completed by a fairing, made of a light material such as fibreglass, composite or plastic, consisting of one or more parts 19, which is designed to improve the hydrodynamics of the system.

[0033] The solution described, which requires the mechanical parts to be separated from the supporting structure, solves the problems of weight and easy adaptability to various boat designs.

[0034] The boxes, with systems that provide the seal around the rotating shafts, are known and can be made at limited cost, while the supporting structure described above, with a pair of sleeves fixed to the ends of arms

welded to a plate secured to the boat, is light and easily adapted to a wide variety of hull inclinations, merely by varying the length of the arms, with no need to modify moulds or anything else.

[0035] The drive unit structure obtained with the solution described is light and easily adapted to a wide variety of keel geometries at low cost.

Claims

1. Drive unit for stern-drive boats, **characterised in that** it includes a structure (10) that supports the parts (7, 5) which transmit motion from an inverter (6), located at engine output (3), to the propeller, consisting of a plate (11) secured to the keel of the boat, to which are attached a plurality of arms (12, 13, 14) which support means (15, 16) designed to house box-shaped elements (17, 18) into which said drive parts pass.
2. Drive unit for stern-drive boats as claimed in claim 1, **characterised in that** said structure (10) which supports the drive parts consists of a plate (11) to which are connected a pair of V-shaped arms, with a first sleeve (15) fitted at the lower ends thereof, and a third arm with a second sleeve (16) fitted at the lower end thereof, which said sleeves (15, 16) house a box (17) to which lead propeller shaft (5) and a shaft (7) orthogonal to it, leading from a motion inverter, seal means being fitted between said box (17) and said shafts (5, 7);
3. Drive unit for stern-drive boats as claimed in claim 2, wherein said V-shaped arms (12, 13) are located in the front part of the plate, and said third arm (14) is located at the rear, in a central position.
4. Drive unit for stern-drive boats as claimed in claim 3, wherein said sleeves (15, 16) are aligned.
5. Drive unit for stern-drive boats as claimed in claim 4, **characterised in that** it includes a shell designed to enclose said box (17), which said shell consists of elements (19) designed to be fitted to said sleeves (15, 16) to produce a casing designed to improve the hydrodynamics of the system.
6. Drive unit for stern-drive boats as claimed in claim 1, **characterised in that** it includes:
 - a plate (11) attached to the keel of the boat, to which are connected a pair of V-shaped arms (12, 13) with a first sleeve (15) fitted at the lower ends thereof;
 - a third arm (14) with a second sleeve (16) fitted at the lower end thereof;
 - a box (17) mounted on said sleeves (15, 16),

to which said box lead propeller shaft (5) and a shaft (7) orthogonal to it, which leads from a motion inverter;

- seal means between said box (17) and said shafts (5, 7);

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7. Drive unit for stern-drive boats as claimed in claim 6, **characterised in that** a motion inverter unit (6) is fitted between engine shaft (4) and said drive shaft (7), which said motion inverter unit comprises a transmission with two coaxial bevel gears, fitted opposite one another on the same engine shaft, which engage a conical cogwheel mounted on said drive shaft (7), and means designed to make one or other of said bevel gears integral with said engine shaft.
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8. Drive unit for stern-drive boats as claimed in claim 7, **characterised in that** it includes a shell designed to enclose said box (17), which said shell consists of elements (19) designed to be fitted to said sleeves (15, 16) to produce a casing designed to improve the hydrodynamics of the system.
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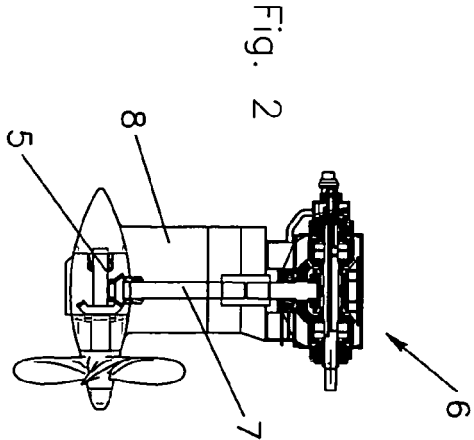
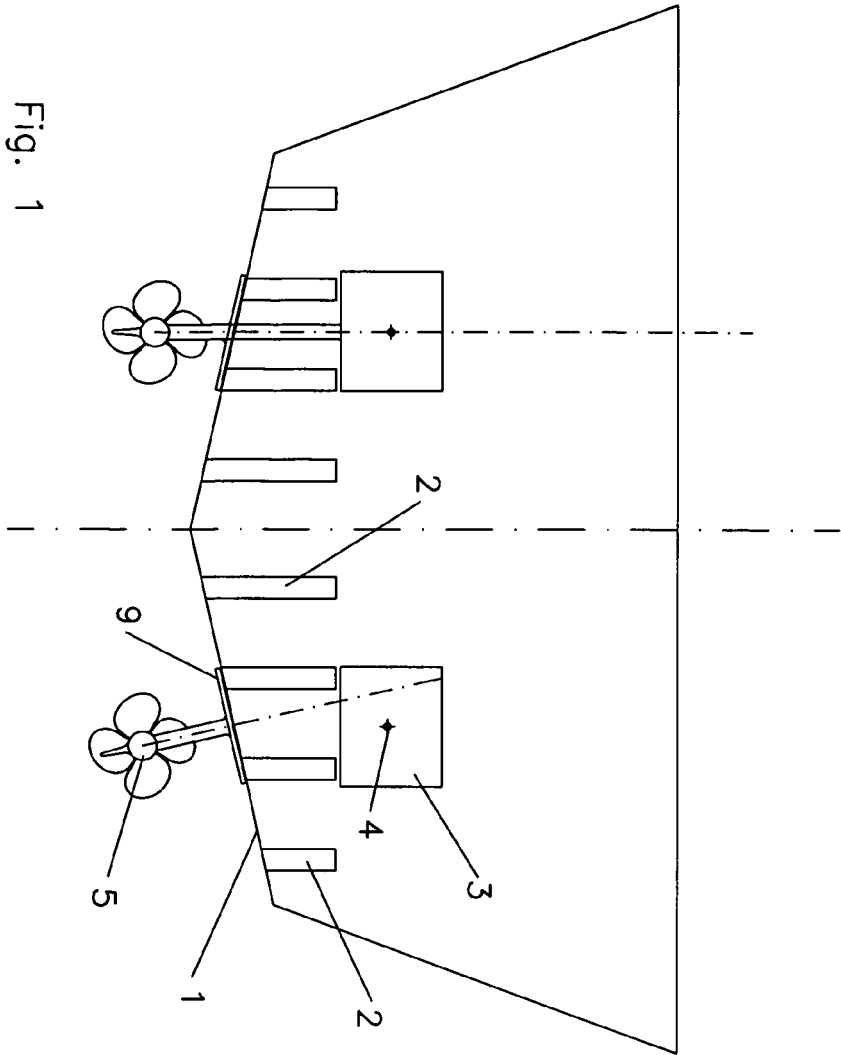
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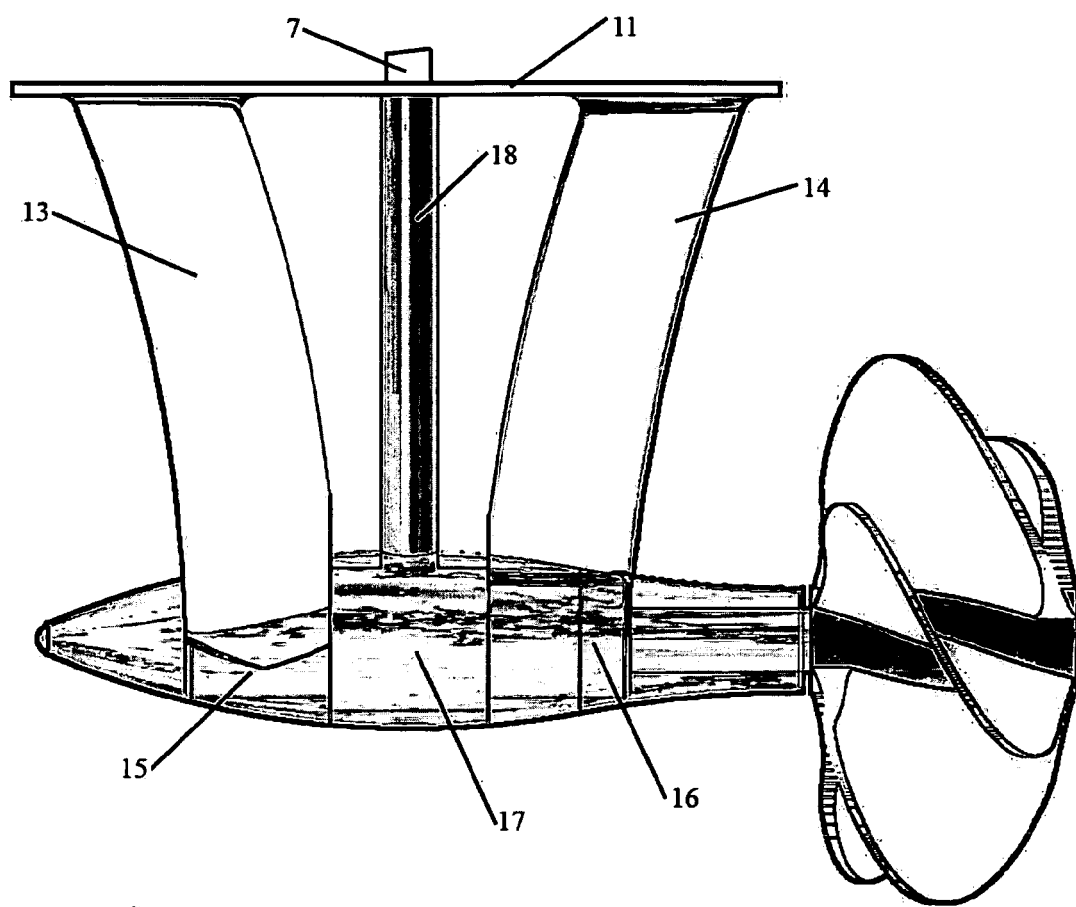


Fig. 3

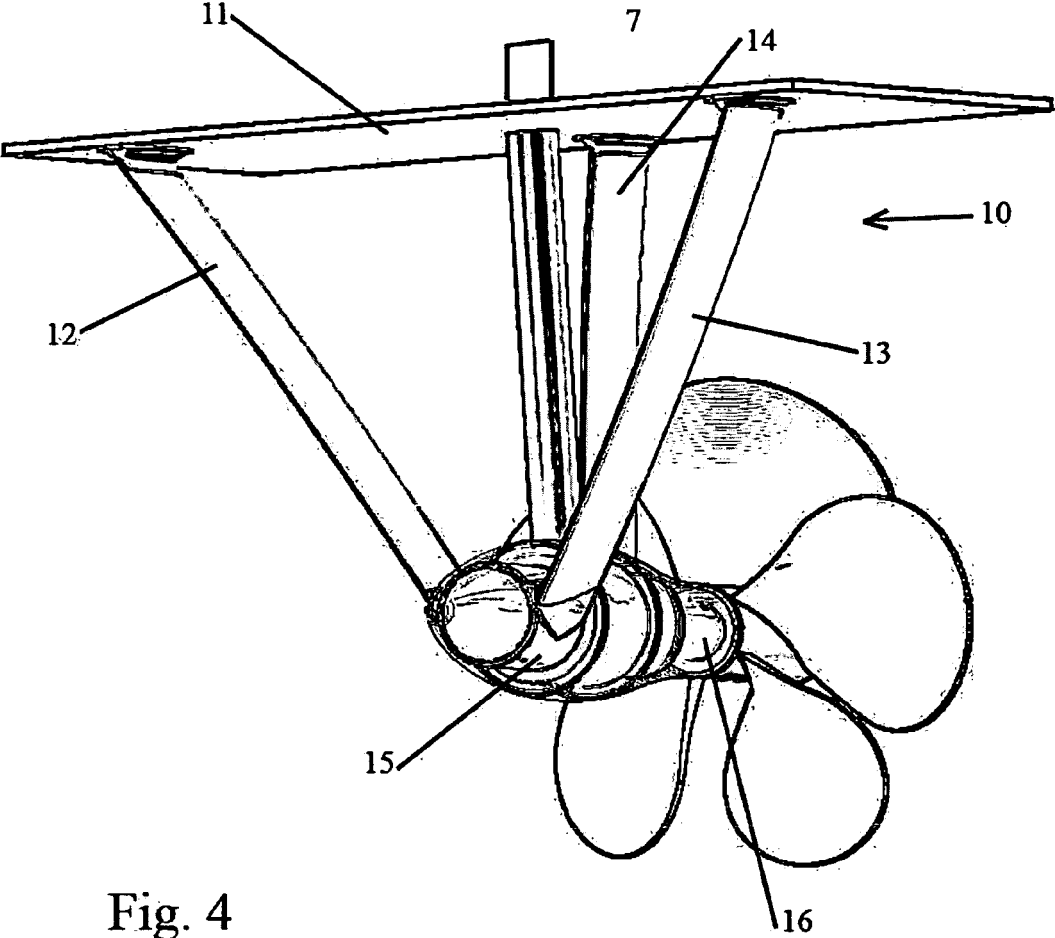


Fig. 4

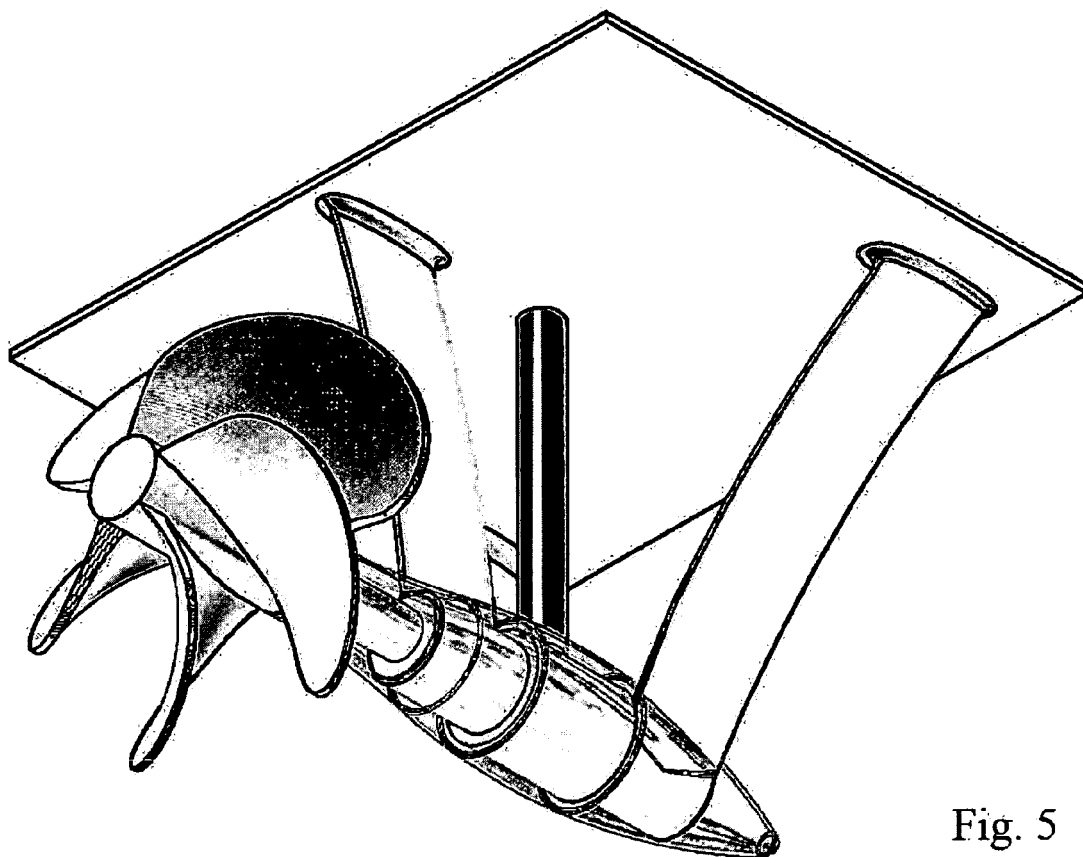


Fig. 5

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