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(54) **PODDED ALL-DIRECTION PUMP-JET VECTOR PROPELLER**

ALLRICHTUNGSVEKTORPUMPENDÜSENPROPELLER MIT POD

PROPULSEUR VECTORIEL À HYDROJET OMNIDIRECTIONNEL À NACELLE

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• **LIU, WENFENG ET AL.: 'Analysis of Construction
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Underwater Integrated Motor Propulsor'
TORPEDO TECHNOLOGY vol. 15, 31 December
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EP 3 141 472 B1

Description

FIELD OF THE INVENTION

[0001] The present disclosure relates to a propeller, and more particular, relates to a podded all-direction pump-jet vector propeller.

BACKGROUND OF THE INVENTION

[0002] With the development of intelligent equipment and technologies in recent years, the traditional measurement mode of taking water from water areas such as ocean, lake, coast, harbor, and reservoir by human being has been changed. The new developed unmanned measurement vessel was applied in this fields more and more widely. The unmanned measurement vessel is based on the main technologies of unmanned vessel, particularly, integrated with a measurement device to collect samples and process data. Furthermore, the analyzed results can be transmitted to the shore base through communication devices at real time. The unmanned measurement vessel can be worked at autonomous and remote control modes, respectively. And the sensing devices in the vessel were operated through remote control. Based on these solutions, the vessel can take the replace of human being to reach to the dangerous regions such as the shoal and near-shore.

[0003] At present, there are some problems with the unmanned vessel during the actual working process, such as sucking air, vacuole and insufficient suction which emerge easily when in a low-speed running without pressure, and the stepped water inlet of the underwater pump-jet being entangled by the aquatic plants easily. Further, a water spray system requires a complicated reversing system, and when a fine angle adjustment in linear sailing and steering are performed, the whole power system should be steered, thereby generating a greater resistance and energy consumption. It is difficult to install and maintain the underwater pump-jet, and its operational performance is poor, and therefore, it lacks flexibility, and is inefficient and insecure.

[0004] US 2004/203298 A1 refers to a ship low-noise hydrojet propeller unit with good performance. It mainly comprises a hydrojet propeller assembly consisting of a hydraulic screw feeding a helico-axial pump emerging in the diffusers. A nozzle completes the assembly, which is powered by lateral louvers. The electric motor is axially represented, but may be radial. The shaft is rotatably mounted, through hydraulic thrust bearings. The assembly can be have azimuthal orientation. The invention is applicable to ships and submarines.

[0005] US 2007/270052 A1 refers to a pod ship propulsion system comprising a housing connected to a ship hull, an electric drive motor mounted inside the housing at least one propeller disposed outside the housing, wherein said electric drive motor is connected to the propeller by means a hydrodynamic gear.

[0006] US 6790109 B1 refers to an electrical steering propeller for a seagoing high-speed ship having a poly-phase electric motor which is mounted under the stern of the ship via a shaft which can rotate and preferably has two parts in a gondola-like housing, and can be supplied with electrical drive power via a slipring arrangement, and can be rotated via drive motors, wherein the steering propeller is mounted in the stern of the ship via a flat collar bearing in the vicinity of the outer skin, in particular above the waterline, with the slipring arrangement being accommodated in the upper part of the shaft at the level of the annular bearing, and with the drive motors for the rotary movement being physically small and being arranged at least partially in the interior of the collar bearing.

[0007] US 2003/140836 refers to a ship comprising: a main propeller which can move the ship forward and reverse by normal rotation, reverse rotation or by changing the pitch angle; a drive unit which drives the main propeller; a rudder which changes the course of the ship; and at least one pod propulsion unit. As a result, the support mechanism and the turning mechanism of the pod propulsion unit arranged separated to the main propeller can be simplified, and cost can be reduced.

[0008] At present, a Chinese patent with a publication No: 20217519U discloses a vector propeller, which includes a propeller shell having two opening ends, a motor shell fixed in the propeller shell via a star-shaped bracket, and a power motor fixed in the motor shell. The star-shaped bracket defines a plurality of passages which allow water flow to pass through, the plurality of passages are arranged along an axial direction of the propeller shell. A pressurized front spindle is mounted on an end of the power motor, and a pressurized front turbofan assembly is mounted on the pressurized front spindle. A pressurized rear turbofan assembly is mounted on an opposite end of the power motor. The motor shell remains sealed. The vector propeller further includes a frequency modulation motor and a hollow shaft. An output shaft of the frequency modulation motor is fixed to one end of the hollow shaft, and the other end of the hollow shaft is fixed to the propeller shell and the motor shell, a space between the hollow shaft and the motor shell remains sealed. When the vessel or the submarine is required to be turned around, it is controlled by the frequency modulation motor. Although the technical solutions of this patent can guarantee a sufficient driving force when the vessel turns, it has a complicated structure. When this structure is applied to the unmanned vessel, particularly a small-sized unmanned vessel, the whole power system should be steered when a fine angle adjustment in linear sailing and steering are performed, thereby generating a greater resistance and a higher power consumption. In addition, the problem of entangling of the aquatic plants cannot be perfectly avoided.

SUMMARY

[0009] The technical problem to be solved by the present disclosure is to address the shortcomings of the prior art and to provide a podded all-direction pump-jet vector propeller having a simple structure, a high installation flexibility, a high degree of integration, a high safety performance, and flexible and diverse control, and an improved working efficiency.

[0010] The technical solution adopted by the present disclosure is that, the present disclosure provides in accordance with claim 1 an annular impeller cover adapted to the said impeller, wherein an annular filter cover is located between the said annular impeller cover and the said motor, an end of the said annular filter cover is fixed to the said motor, an opposite end of the said annular filter cover is connected to annular impeller cover; wherein the said annular impeller cover is provided with a guiding impeller on a jet of the said annular impeller cover, when working, the said fluid successively flows through the said annular impeller cover and the said guiding impeller, and is then sprayed out; wherein a guiding tube which can rotate along X, Y axis directions is hinged to an outer side of a jet of the said annular impeller cover, further comprising a vector steering engine I and a vector steering engine II connected to the said guiding impeller for transmission, wherein the said guiding impeller is transmitted by the said vector steering engine I and the said vector steering engine II via an universal coupling mechanism to realize an adjustment having two degrees of freedom, a lateral direction and a longitudinal direction, wherein both the said vector steering engine I and the said vector steering engine II are 60-90 degrees steering engines, and wherein the vector steering engine I and the vector steering engine II are all connected to the guiding impeller or the guiding tube via a steel wire for transmission.

[0011] The present disclosure further includes an annular impeller cover adapted to the impeller, wherein an annular filter cover is located between the annular impeller cover and the motor, an end of the annular filter cover is fixed to the motor, and an opposite end of the annular filter cover is connected to the annular impeller cover.

[0012] The annular filter cover defines a plurality of water inlets uniformly distributed thereon, and a longitudinal extending direction of the plurality of water inlets is the same as a spray direction of fluid.

[0013] The annular impeller cover is provided with a guiding impeller on a jet thereof, when working, the fluid successively flows through the annular impeller cover and the guiding impeller, and is then sprayed out.

[0014] A guiding tube which can rotate along X, Y axis directions is hinged to an outer side of a jet of the annular impeller cover.

[0015] The podded all-direction pump-jet vector propeller further includes a vector steering engine I and a vector steering engine II, which are all connected to the guiding impeller, the guiding impeller is transmitted by

the vector steering engine I and the vector steering engine II via a universal coupling mechanism to realize an adjustment having two degrees of freedom, a lateral direction and a longitudinal direction.

[0016] Both the vector steering engine I and the vector steering engine II are 60-90 degrees steering engines.

[0017] The vector steering engine I and the vector steering engine II are all connected to the guiding impeller via a steel wire for transmission.

[0018] The output shaft is sleeved with a sealing cover, an upper end of the sealing cover hermetically engages the output shaft, and a lower end of the sealing cover hermetically engages an end of the motor.

[0019] An upper end of the suspension arm is provided with a minor axis having three branches of large current slipping rings, the minor axis is connected to the 360 degrees steering engine for transmission.

[0020] Advantages of the present disclosure is that: because the present disclosure includes a controller, a suspension arm, a motor fixedly located beneath the suspension arm and electrically connected to the controller, and an impeller located on an output shaft of the motor, and a 360 degrees steering engine is connected to an upper end of the suspension arm for transmission, and the 360 degrees steering engine is electrically connected to the controller, the present disclosure has a simple structure, a high installation flexibility, and a high degree of integration. The controller controls the 360 degree steering engine to rotate by a signal, thus realizing rotation control of any angle of the suspension arm within 360 degrees, such that the reversing of the hull becomes convenient and simple, and a working efficiency of the vessel can be effectively increased, the problem of complicated reversing system in the conventional water spray system is solved.

[0021] The present disclosure further includes an annular impeller cover adapted to the impeller, an annular filter cover is located between the annular impeller cover and the motor, an end of the annular filter cover is fixed to the motor, and an opposite end of the annular filter cover is connected to the annular impeller cover, therefore the problem of the conventional stepped water inlet of the underwater pump-jet being entangled by the aquatic plants can be avoided, and a safety performance can be greatly enhanced. In addition, the inlet of the annular filter cover is located below the waterline, and the problems of sucking air, vacuole and insufficient suction of the normal pump-jet impeller when in a low-speed running without pressure are resolved.

[0022] Furthermore, the podded all-direction pump-jet vector propeller further includes a vector steering engine I and a vector steering engine II, which are connected to the guiding impeller for transmission. The guiding impeller can realize an adjustment having two degrees of freedom, a lateral direction and a longitudinal direction due to the vector steering engine I and the vector steering engine II, thus the control is flexible and diverse. When a fine angle adjustment in linear sailing and steering are

performed to the vessel, there is no need to steer the whole power system, thereby the problems of a greater resistance and a greater energy consumption are avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] FIG. 1 is a schematic diagram of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0024] As shown in FIG. 1, in the illustrated embodiment, the present disclosure includes a controller 1, a suspension arm 2, a motor 3 fixedly located beneath the suspension arm 2 and is electrically connected to the controller 1, and an impeller 5 located on the output shaft 4 of the motor 3. A 360 degrees steering engine 6 is connected to an upper end of the suspension arm 2 for transmission, and the 360 degrees steering engine 6 is electrically connected to the controller 1.

[0025] The present disclosure further includes an annular impeller cover 7 adapted to the impeller 5. An annular filter cover 8 is located between the annular impeller cover 7 and the motor 3. An end of the annular filter cover 8 is fixed to the motor 3, and an opposite end is connected to annular impeller cover 7.

[0026] The annular filter cover 8 defines a plurality of water inlets 9 uniformly distributed thereon. In the illustrated embodiment, a longitudinal extending direction of the plurality of water inlets 9 is the same as a spray direction of fluid.

[0027] A guiding impeller 10 is located on a jet of the annular impeller cover 7. When working, the fluid successively flows through the annular impeller cover 7 and the guiding impeller 10, and is then sprayed out.

[0028] A guiding tube 11 which can rotate along X, Y axis directions is hinged to an outer side of the jet of the annular impeller cover 7. The guiding tube 11 can enable a traveling direction of the vessel to be more accurate.

[0029] The podded all-direction pump-jet vector propeller further includes a vector steering engine I 12 and a vector steering engine II 13 which are connected to the guiding impeller 10 for transmission, the guiding impeller 10 is transmitted by the vector steering engine I 12 and the vector steering engine II 13 to realize an adjustment having two degrees of freedom, a lateral direction and a longitudinal direction.

[0030] Both the vector steering engine I 12 and the vector steering engine II 13 are 60-90 degrees steering engines.

[0031] In the illustrated embodiment, the vector steering engine I 12 and the vector steering engine II 13 are all connected to the guiding impeller 10 or the guiding tube 11 via a steel wire 14 for transmission.

[0032] The output shaft 4 is sleeved with a sealing cover 15, and an upper end of the sealing cover 15 hermetically engages the output shaft 4. A lower end of the seal-

ing cover 15 hermetically engages an end of the motor 3, and a waterproof performance of the motor 3 is further guaranteed.

[0033] An upper end of the suspension arm 2 is provided with a minor axis 16 having three branches of large current slipping rings, the minor axis 16 is connected to the 360 degrees steering engine 6 for transmission. In the illustrated embodiment, the minor axis 16 is rotatably and hermetically connected to a bottom of a hull 17.

[0034] When the present disclosure is utilized, the controller, the 360 degrees steering engine 6, the vector steering engine I 12, and the vector steering engine II 13 are all located in the hull 17. The minor axis 16 is rotatably and hermetically connected to the bottom of the vessel 17. The motor 3 works in an underwater full-sealed state, and a direct water cooling is adopted, at the same time, the three branches of large current slipping rings are employed to transmit current for the motor 3. The two small sized 60-90 degrees steering engines realize an infinite angle adjustment of the guiding impeller 10 along the X axis and the Y axis via the steel wire 14. The impeller 10 performs an adjustment by changing the water flow direction, thereby realizing a fine adjustment of a direction of a driving force, when a fine angle adjustment in linear sailing and steering are performed to the vessel, there is no need to steer the whole power system, thereby the problems of a greater resistance and a greater energy consumption are avoided, such that a cruising power of the vessel is further enhanced.

[0035] The podded all-direction pump-jet vector propeller is a novel marine propelling mechanism which incorporates a propelling mechanism and a steering mechanism. In the podded all-direction pump-jet vector propeller, the motor 3 is disposed outside the vessel and is directly connected to the impeller 5, thus it can rotate horizontally within 360 degrees to realize a vector advance.

[0036] The present disclosure is applied to a technical field of marine vector propeller.

[0037] Although the invention is illustrated and described herein with reference to specific embodiments, the invention is not intended to be limited to the details shown.

Claims

1. A podded all-direction pump-jet vector propeller, comprising: a controller (1), a suspension arm (2), a motor (3) fixedly located beneath the said suspension arm (2) and electrically connected to the said controller (1), and an impeller (5) located on an output shaft (4) of the said motor (3), wherein a 360 degrees steering engine (6) is connected to an upper end of the said suspension arm (2) for transmission, and the said 360 degrees steering engine (6) is electrically connected to the said controller (1), wherein the said propeller further comprises an annular filter

cover (8) and an annular impeller cover (7) adapted to the said impeller (5), the said annular impeller cover (7) being provided with a guiding impeller (10) on a jet of the said annular impeller cover (7), when working, fluid successively flowing through the said annular impeller cover (7) and the said guiding impeller (10), and being then sprayed out; **characterised in that** the said annular filter cover (8) is located between the said annular impeller cover (7) and the said motor (3), an end of the said annular filter cover (8) being fixed to the said motor (3), and an opposite end of the said annular filter cover (8) being connected to the said annular impeller cover (7); **in that** a guiding tube (11) which can rotate along X, Y axis directions is hinged to an outer side of a jet of the said annular impeller cover (7); and **in that** the said propeller further comprises a vector steering engine I (12) and a vector steering engine II (13) connected to the said guiding impeller (10) for transmission, wherein the said guiding impeller (10) is transmitted by the said vector steering engine I (12) and the said vector steering engine II (13) via a universal coupling mechanism to realize an adjustment having two degrees of freedom, a lateral direction and a longitudinal direction, wherein both the said vector steering engine I (12) and the said vector steering engine II (13) are 60-90 degrees steering engines, and wherein the said vector steering engine I (12) and the said vector steering engine II (13) are all connected to the said guiding impeller (10) or the said guiding tube (11) via a steel wire (14) for transmission.

2. The said podded all-direction pump-jet vector propeller according to claim 1, wherein the said annular filter cover (8) defines a plurality of water inlets (9) uniformly distributed thereon, a longitudinal extending direction of the said plurality of water inlets (9) is the said same as a spray direction of fluid.
3. The said podded all-direction pump-jet vector propeller according to claim 1, wherein the said vector steering engine I (12) and the said vector steering engine II (13) are connected to the said guiding impeller (10) by a steel wire (14) for transmission.
4. The said podded all-direction pump-jet vector propeller according to claim 1, wherein the said output shaft (4) is sleeved with a sealing cover (15), an upper end of the said sealing cover (15) hermetically engages the said output shaft (4), and a lower end of the said sealing cover (15) hermetically engages an end of the said motor (3).
5. The said podded all-direction pump-jet vector propeller according to claim 1, wherein an upper end of the said suspension arm (2) is provided with a minor axis (16) having three branches of large current slipping rings, the said minor axis (16) is connected to

the said 360 degrees steering engine (6) for transmission.

5 Patentansprüche

1. Allrichtungsvektorpumpendüsenpropeller mit Pod, aufweisend: eine Steuerung (1), einen Aufhängungsarm (2), einen Motor (3), der starr unterhalb des Aufhängungsarms (2) angeordnet und elektrisch mit der Steuerung (1) verbunden ist, und ein Laufrad (5), das sich an einer Abtriebswelle (4) des Motors (3) befindet, wobei eine 360-Grad-Lenkmaschine (6) mit einem oberen Ende des Aufhängungsarms (2) zur Transmission verbunden ist und die 360-Grad-Lenkmaschine (6) elektrisch mit der Steuerung (1) verbunden ist, wobei der Propeller ferner eine ringförmige Filterabdeckung (8) und eine ringförmige Laufradabdeckung (7) aufweist, die an das Laufrad (5) angepasst ist, wobei die ringförmige Laufradabdeckung (7) mit einem Führungslaufrad (10) auf einer Düse der ringförmigen Laufradabdeckung (7) versehen ist, im Betrieb Fluid nacheinander durch die ringförmige Laufradabdeckung (7) und das Führungslaufrad (10) strömt und dann ausgesprüht wird; **dadurch gekennzeichnet, dass** sich die ringförmige Filterabdeckung (8) zwischen der ringförmigen Laufradabdeckung (7) und dem Motor (3) befindet, ein Ende der ringförmigen Filterabdeckung (8) am Motor (3) befestigt ist und ein gegenüberliegendes Ende der ringförmigen Filterabdeckung (8) mit der ringförmigen Laufradabdeckung (7) verbunden ist; dass ein Führungsrohr (11), das entlang X-, Y-Achsenrichtungen drehen kann, an einer Außenseite einer Düse der ringförmigen Laufradabdeckung (7) angelenkt ist; und dass der Propeller ferner eine Vektorlenkmaschine I (12) und eine Vektorlenkmaschine II (13) aufweist, die zur Transmission mit dem Führungslaufrad (10) verbunden sind, wobei das Führungslaufrad (10) durch die Vektorlenkmaschine I (12) und die Vektorlenkmaschine II (13) über einen Universalkupplungsmechanismus zum Ausführen einer Anpassung mit zwei Freiheitsgraden, einer Seitenrichtung und einer Längsrichtung übertragen wird, wobei sowohl die Vektorlenkmaschine I (12) als auch die Vektorlenkmaschine II (13) 60- bis 90-Grad-Lenkmaschinen sind, und wobei die Vektorlenkmaschine I (12) und die Vektorlenkmaschine II (13) alle mit dem Führungslaufrad (10) oder dem Führungsrohr (11) über einen Stahldraht (14) zur Transmission verbunden sind.
2. Allrichtungsvektorpumpendüsenpropeller mit Pod nach Anspruch 1, wobei die ringförmige Filterabdeckung (8) mehrere Wassereinlässe (9) definiert, die einheitlich darauf verteilt sind, wobei eine Längsverlaufsrichtung der mehreren Wassereinlässe (9) dieselbe wie eine Sprühdichtung von Fluid ist.

3. Allrichtungsvektorpumpendüsenpropeller mit Pod nach Anspruch 1, wobei die Vektorlenkmaschine I (12) und die Vektorlenkmaschine II (13) durch einen Stahldraht (14) zur Transmission mit dem Führungslaufrad (10) verbunden sind.
4. Allrichtungsvektorpumpendüsenpropeller mit Pod nach Anspruch 1, wobei die Abtriebswelle (4) mit einer Abdichtungsabdeckung (15) umhüllt ist, wobei ein oberes Ende der Abdichtungsabdeckung (15) die Abtriebswelle (4) hermetisch in Eingriff nimmt und ein unteres Ende der Abdichtungsabdeckung (15) ein Ende des Motors (3) hermetisch in Eingriff nimmt.
5. Allrichtungsvektorpumpendüsenpropeller mit Pod nach Anspruch 1, wobei ein oberes Ende des Aufhängungsarms (2) mit einer Nebenachse (16) mit drei Zweigen von großen Stromrutschringen versehen ist, wobei die Nebenachse (16) mit der 360-Grad-Lenkmaschine (6) zur Transmission verbunden ist.

Revendications

1. Propulseur vectoriel à hydrojet omnidirectionnel à nacelle, comprenant:
un dispositif de commande (1), un bras de suspension (2), un moteur (3) disposé de façon fixe au-dessous du bras de suspension (2) et relié électriquement audit dispositif de commande (1), et une roue à aubes (5) disposée sur un arbre de sortie (4) dudit moteur (3), un moteur de direction (6) à 360 degrés étant relié à une extrémité supérieure dudit bras de suspension (2) pour transmission, et ledit moteur de direction (6) à 360 degrés étant connecté électriquement audit dispositif de commande (1), ledit propulseur comprenant en outre un couvercle de filtre annulaire (8) et un couvercle de roue annulaire (7) adapté à ladite roue à aubes (5), ledit couvercle de roue annulaire (7) étant muni d'une roue de guidage (10) sur un jet dudit couvercle de roue annulaire (7), en fonctionnement, un fluide circulant successivement dans ledit couvercle de roue annulaire (7) et ladite roue de guidage (10) et étant ensuite éjecté;
caractérisé en ce que ledit couvercle de filtre annulaire (8) est situé entre ledit couvercle de roue annulaire (7) et ledit moteur (3), une extrémité dudit couvercle de filtre annulaire (8) étant fixée audit moteur (3), et une extrémité opposée dudit couvercle de filtre annulaire (8) étant reliée audit couvercle de roue annulaire (7); **en ce qu'**un tube de guidage (11) qui peut tourner dans les directions des axes X et Y est articulé sur un côté extérieur d'un jet dudit couvercle de roue annulaire (7); et **en ce que** ladite roue à aubes comprend en outre un moteur de direction vectoriel I (12) et un moteur de direction vectoriel II (13) reliés à ladite roue de guidage (10) pour trans-

mission, ladite roue de guidage (10) étant transmise par ledit moteur de direction vectoriel I (12) et ledit moteur de direction vectoriel II (13) via un mécanisme de couplage universel pour réaliser un ajustement ayant deux degrés de liberté, une direction latérale et une direction longitudinale, ledit moteur de direction vectoriel I (12) et ledit moteur de direction vectoriel II (13) étant tous deux des moteurs de direction à 60-90 degrés, et ledit moteur de direction vectoriel I (12) et ledit moteur de direction vectoriel II (13) étant tous reliés à ladite roue de guidage (10) ou audit tube de guidage (11) via un fil d'acier (14) pour transmission.

2. Propulseur vectoriel à hydrojet omnidirectionnel à nacelle selon la revendication 1, dans lequel le couvercle de filtre annulaire (8) définit une pluralité d'entrées d'eau (9) réparties uniformément sur celui-ci, une direction s'étendant longitudinalement de la pluralité des entrées d'eau (9) étant la même que la direction d'éjection du fluide.
3. Propulseur vectoriel à hydrojet omnidirectionnel à nacelle selon la revendication 1, dans lequel le moteur de direction vectoriel I (12) et le moteur de direction vectoriel II (13) sont reliés à la roue de guidage (10) par un fil d'acier (14) pour transmission.
4. Propulseur vectoriel à hydrojet omnidirectionnel à nacelle selon la revendication 1, dans lequel ledit arbre de sortie (4) est revêtu d'un couvercle d'étanchéité (15), une extrémité supérieure dudit couvercle d'étanchéité (15) engage hermétiquement ledit arbre de sortie (4), et une extrémité inférieure dudit couvercle d'étanchéité (15) engage hermétiquement une extrémité dudit moteur (3).
5. Propulseur vectoriel à hydrojet omnidirectionnel à nacelle selon la revendication 1, dans lequel une extrémité supérieure du bras de suspension (2) est munie d'un axe secondaire (16) ayant trois branches de bagues de glissement à courant élevé, ledit axe secondaire (16) étant relié audit moteur de direction (6) à 360 degrés pour transmission.

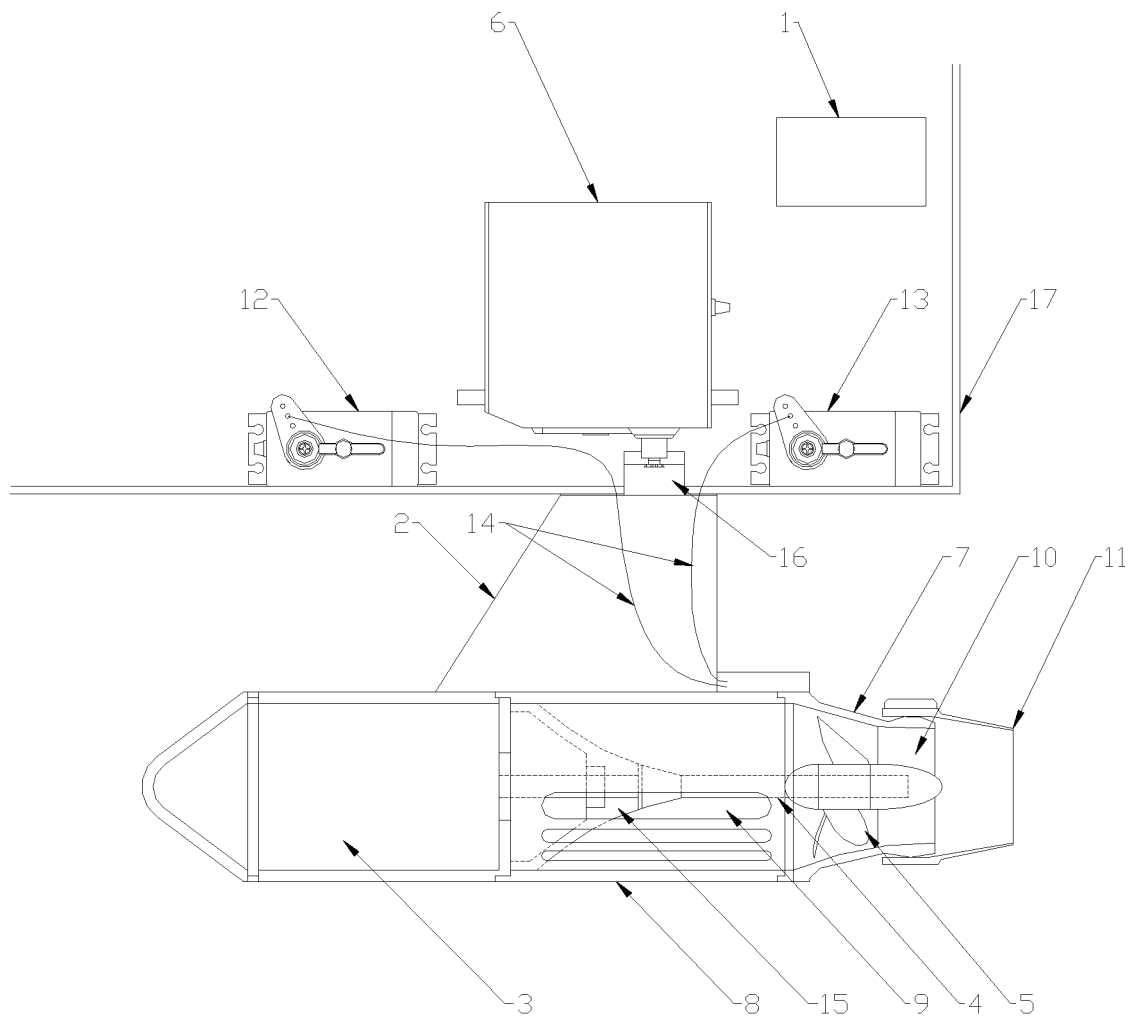


FIG. 1

REFERENCES CITED IN THE DESCRIPTION

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