IMPROVED DIVER JET PROPULSION SYSTEM

Field of the Invention

The invention relates to the assisted diving systems and, in particular, systems to increase the speed and manoeuvrability of a diver.

Background

For both recreational and military applications, systems to propel a diver through the water are becoming increasingly popular.

While expensive, the benefit for the diver to increase the effectiveness and efficiency of time spent underwater, through increasing speed and manoeuvrability, often outweigh the cost.

The cost of such systems, however limit their application. Varying environmental conditions, variability between divers and variation in daily application mean different systems need to be employed to cover the intended use. If the user intends to use a propulsion system on a day's outing, where conditions may change during the day, it isn't practical to employ two systems. Not just for the cost, but also the cost/benefit of having a redundant system should conditions not change is a substantial opportunity cost.

Further, these systems are often employed from small craft, far from shore. To have several divers, each having similar systems for the same conditions, it isn't practical for the storage capacity of the craft, to have two propulsion systems per diver.

It would therefore be beneficial if a propulsion system be introduced that extends its applicability to changing environmental conditions.

Summary of Invention

In a first aspect, the invention provides an underwater propulsion system arranged to propel a diver, the system comprising: a harness arranged to be coupled to the diver, said harness having a pair of thruster modules; said thruster modules having two or more selectively removable thrusters, and; a control system arranged to control operation of the thruster modules and detect how many thrusters are attached to the harness.

The invention therefore provides a control system arranged to control operation of thruster modules of the propulsion system, and detect how many thrusters are engaged.

Thus, a jet propulsion system may be capable of selectively mounting one or more thruster modules, with the control system used to control the system being able to detect the number of thrusters in any given configuration, and control the system accordingly.

The underwater propulsion system may further include a harness arranged to be coupled to the diver, said harness arranged to receive the one or more of thruster modules. Together, the invention may provide a diving tactic suit, which is made up of a control system, a mounting harness to which are mounted at least one selectively removable thruster.

Brief Description of Drawings

It will be convenient to further describe the present invention with respect to the accompanying drawings which illustrate possible arrangements of the invention. Other arrangements of the invention are possible, and consequently the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figures 1A to 1E are various views of a jet propulsion system according to one embodiment of the present invention;

Figures 2A to 2G are various views of a jet propulsion system according to further embodiment of the present invention, and;

Figure 3 is an isometric view of "U" plate for thruster connection for a jet propulsion system according to a further embodiment of the present invention.

Detailed Description

Figures 1A to 1E show e embodiment of the diver jet propulsion system according to one embodiment.

Here a belt harness 17 is arranged to be worn by a diver. The belt harness 17 is selectively removable using nylon strap with connect & disconnect buckle fasteners 9, 10, 16A, 16B, 19A, 19B, 22A, 22B, 23A, 23B, 24, 25. Similarly, the system is worn about the thighs of the

diver using thigh belt harness 11A, 11B. Mounted to each thigh harness 11A, 11B are aluminium mounting plates 12A, 12B which act to secure thruster modules to the thigh harness. The thruster modules include one or more thrusters 1a to 1d, with each thruster in data and electrical communication with a control box 2. The type of thrusters may be typical diver propulsion systems, such that the type of thruster used may be suitable for its application. It follows that thrusters used for military and commercial use may be different from those used for recreational purposes, but may share common aspects such as being electric motors, sealed in a non-corrosive casing and capable of propelling the diver at an appropriate speed, for an appropriate length of time. It will be appreciated that the type of thruster is not an imitation of the invention, and any suitable device may be used as a thruster.

This embodiment further includes a series of quick release components for removing the thrusters from the thruster system, and the thigh harness in particular. These include a pair of underwater connectors 13A, 13B as quick release connectors between the power supply 7, control box 2 and the thrusters. In this embodiment, the power supply includes a 48V, 55Ah battery 7 which is also mounted to the body harness, and positioned ergonomically on the back of the diver. Next are lock hinges 14A, 14B used for quick release between the body harness & thruster system The system further includes a pair of aluminium “U” plates 15A,15B attached to the thruster to allow for conversion between the single and twin thruster configuration, with a further aluminium plate 21A,21B to connect the “U” plate attached on the thruster.

Figure 1E shows a control box 2 providing the control system for controlling operation of the thrusters. The control box 2 includes a power switch 3 a speed controller 4 and a battery

indicator 6. The battery indicator is activated by toggling switch 5 between the modes of battery indicator and monitoring. The control box 2 is mounted to the belt harness through mounting 27. Operational control is provided by the signal input 28 and power input 29.

The quick release system 14A, 14B, 15A, 15B, 21A and 21B allows divers to detach and/or attach the thrusters to the harness and at the same time, once the thrusters are linked via the connectors 28 and 29, the control box is able to intelligently detect the number of attached thrusters and accordingly deliver the necessary power to the attached thruster(s). The quick release system therefore provide divers with the much-needed option(s) and flexibility given the nature of work in relation to divers. Some examples are, (1) sea level and sea current changes from time to time, with the ability to connect and disconnect, the diver is able to decide whether to tap on the motor for additional power or whether to conserve power; or (2) with the quick release system (of both the harness and/or the thrusters), there is the option to allow divers to change harness/thruster quickly (underwater or not) so as to achieve mission objective(s).

As discussed, for the propulsion system according to the present invention, the ability to modify the system through mounting or demounting thrusters allows for a wider range of environmental conditions. Apart from the clear cost saving, the required equipment to cover such a wide range of conditions is substantially less, and so storage capacity of a smaller craft is not comprised.

Figures 2A to 2E show a third embodiment of the present invention. Here, a thigh mountable thruster module 30 associated with a larger jet propulsion system (not shown) shows the sequential steps in removing one thruster from the thruster module.

In this embodiment two thrusters 35A, 35B are selectively mountable to a thigh harness 40 through a cooperatively shaped (arrangement) 45B selectively mounting the thruster 35B to the thigh harness 40. Preventing removal of the thruster 35B is a pin 50B providing interference fit between the thruster and thigh harness and so keeping the thruster in place. It will be appreciated that the pin 50B is of sufficient strength in shear capacity to transmit load between the thruster and thigh harness during operation.

To remove the thruster 35B, the pin 50B is removed 55 with the thruster 35B disengaging from the cooperative bracket 45B through upward sliding 60. Once released from the bracket the thruster is removed 65 and thus converting the thruster module to a single thruster configuration.

Not mentioned during the discussion regarding Figures 2A to 2E is the disengagement of the power supply from the battery which is readily achieved through, for instance, disengagement of the underwater connector 13A, 13B as shown in the previous embodiment.

Further, as previously mentioned, the control system residing within the control box 2 through an interrogation of the thruster modules via the underwater connector will determine that one thruster has been removed and thus reconfiguring control to being a one thruster per thruster module configuration and operate accordingly.

Figure 3 shows one embodiment of mutually engaging brackets used for the quick release of a thruster. In this case, the mutually engaging brackets include a U plate 70 on the harness and an engagement plate 80 on the thruster module. The engagement plate 80 is arranged to be in sliding engagement with the U plate, such that on removal, the engagement plate (and thruster module) slide upwards 100 before disengagement.

The engagement plate 80 and U plate 70 may include bevels along peripheral edges, such that the engagement plate bevel is decreasingly inclined towards the thruster module and the U plate bevel is decreasingly inclined towards the harness. On engagement, the bevels may then be in interference, preventing the accidental disengagement of the thruster module.

To prevent accidental sliding disengagement, a locking pin 85 is provided, which is arranged to fit into the thruster aperture 95 and harness aperture 90, which are positioned to align when the thruster module is fully engaged. On full engagement, the locking pin 85 then enters the two apertures and locks in place, securely locking the thruster module to the harness.

Claims

1. An underwater propulsion system arranged to propel a diver, the system comprising:
a harness arranged to be coupled to the diver, said harness having a pair of thruster modules;
said thruster modules having two or more selectively removable thrusters, and;
a control system arranged to control operation of the thruster modules and detect how many thrusters are attached to the harness.

2. The underwater propulsion system according to claim 1, wherein each thruster is in data communication with the control system, said control system arranged to interrogate the thruster modules to determine the number of thrusters operable within each thruster module.

3. The underwater propulsion system according to claim 1 or 2, wherein the harness includes a body harness and a pair of thigh harnesses, said thruster modules mounted to said thigh harnesses.

4. The underwater propulsion system according to claim 3, wherein the thrusters and each thigh harness are mounted through mutually engaging brackets.

5. The underwater propulsion system according to claim 4, wherein the mutually engaging brackets include a U plate and an engagement plate, said engagement plate arranged to be in sliding engagement with the U plate.

6. The underwater propulsion system according to claim 5, wherein the U plate and the engagement plate include bevels on peripheral edges, said bevels arranged to form an interference on engagement of the U plate and the engagement plate.

7. The underwater propulsion system according to claim 5 or 6, wherein the U plate is located on the harness and each thruster module includes the engagement plate.

8. The underwater propulsion system according to any one of claims 4 to 7, each thigh harness further including a removable pin arranged to prevent disengagement of the mutually engaging brackets.