The invention provides a two-seater submarine vessel for independent divers, which vessel is constituted by two similar streamlined shells each carrying one of the divers in known manner, particularly characterised in that these two shells are disposed substantially symmetrically with respect to one another on each side of a plane and are connected to one another by at least one transverse brace or strut at the front, the two shells being fixed at the rear end by cross members disposed between the said symmetrical shells and a third streamlined shell disposed with its plane of symmetry coinciding with the first said plane, this third shell containing a propulsion unit of the assembly which is provided in known manner with diving ailerons at the front and steering and diving governors at the rear, these governors being adapted to be controlled simultaneously by the two divers acting manually in known manner on the device controlling the ailerons at the front, and the other diving means at the rear, and with the feet on the steering means of the vessel.

The description of one embodiment of such a vessel, its control means and a preferred assembly is given by way of non-limitative example, accompanied by diagrammatic drawings, in which:

Figure 1 shows a two-seater submarine vessel according to the invention seen in side elevation;

Figure 2 is a corresponding plan view;

Figure 3 is a first transverse section on the line A—A of Figure 1;

Figure 4 is a second transverse section on the line B—B of Figure 1;

Figure 5 is a third transverse section on the line C—C of Figures 1 and 2.

Figure 6 is a fragmentary transverse elevation, partly in section, showing a manual control of the inclinations of the front ailerons and of the rear depth governors;

Figure 7 is a plan view, partly in section, corresponding to Figure 6;

Figure 8 is a transverse section on the line D—D of Figure 6.

The symmetrical torpedo-like shells are shown here at 1a and 1b respectively without the divers riding them, who are stretched out in known manner with the arms of handlebars 2 underneath them, which they push under the armpits while keeping the curved portions of said handlebars facing forward. The divers are also held firm and pushed by supports which are additionally obtained by bicycle saddles 3 fixed one on each torpedo substantially perpendicular to the latter and with the pointed end facing the said torpedo, symmetrically in parallel vertical planes, by means of supports 4 held on the float of torpedo form by clips 5 of known type. These supports are here tapered at 6. The diver holds the saddle 4 between his thighs and thus forms one with the torpedo.

As the handlebars 2 and the supports 4 are fixed by clips 5, they are readily adjustable to the height of the divers.

The two torpedo shells 1a and 1b are connected at the front end by a streamlined cross-member 7 with its ends 8 widened to adapt it to the corresponding shell and provided with openings 9 through which extend clips or straps 11 on the corresponding shell for tightening the assembly. At the rear end, each torpedo shell carries a rudder bar 12 adapted to be actuated by the feet of the corresponding diver.

Each rudder bar 12 is locked to a control pulley 13 and is fixed for turning movement on a shaft 14 carried vertically in a support 15 on the corresponding shell.

Disposed between the similar shells 1a and 1b in their plane of symmetry is a third streamlined shell 16, which is shorter than the other two and which contains the propulsion motor, for example an electric motor, and carries at its rear end the propulsion propeller 17 (Figure 5) driven thereby, the said propeller being protected in known manner in a streamlined guard ring 18 secured by radial fins 19 of the shell 16, and carrying in rearward extensions the spindle 21 of a conventional rudder 22 and the spindle 23 of a conventional depth governor or hydroplane 24.

The central shell 16 and the lateral shells 1a and 1b are secured together so as to form a unit by two braces formed with openings at 25 and having shoes 26 and 27 adapted respectively to be applied to the corresponding parts of the symmetrical shells 1a and 1b and of the shell 16.

The assembly is secured, for example, by clips or collars 28 and 29 respectively encircling the said shells and passing through the openings 25 to lock the shoes 26 and 27 on these shells.

The parts cross members 25a at the front and at the rear of openings 25 connecting shoes 26 and 27 are advantageously of streamlined section.

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TWO-SEATER SUBMARINE VESSEL

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Light-weight submarine vehicles for divers equipped with independent respiratory apparatus are known in which the equipped diver is immersed in the water in direct contact therewith, carried on a water-tight shell with which he forms a unit, this shell enclosing, protected from the water, driving means actuating an external propulsion system and supporting diving controls operated by the pilot by means of his hands and feet.

These vessels are generally of tapered torpedo form and the enclosed driving means are usually accumulators and an electric motor. They can be enclosed with the pilot in a casing which is at least partially transparent and not water-tight, and which can be opened to permit access of the pilot and may or may not be provided with temporarily inflatable floats, by which the assembly is tilted hydrodynamically.

Such single-seater vessels permit a great variety of evolutions in the water since they are piloted merely in the manner of an aircraft capable of assuming more positions than a conventional submarine, which does not readily exceed positions slightly inclined with respect to the horizontal.

It is desirable, especially for the training of new pilots, to be able to use a two-seater apparatus with dual controls, in which the pupil can see and sense the manoeuvres of the instructor or act as pilot himself within the limits to which the instructor allows him to take control.

The arrangement of the single-seater machine cannot be converted into a two-seater machine for this purpose, and on the other hand it is desirable that the changeover from a two-seater to a single-seater machine does not essentially change the manner in which the pilot is supported by the machine and the manner in which the latter is piloted.

The object of the present invention is to provide a suitable two-seater vessel.

The invention provides a two-seater submarine vessel for independent divers, which vessel is constituted by two similar streamlined shells each carrying one of the divers in known manner, particularly characterised in that these two shells are disposed substantially symmetrically with respect to one another on each side of a plane and are connected to one another by at least one transverse brace or strut at the front, the two shells being fixed at the rear end by cross members disposed between the said symmetrical shells and a third streamlined shell disposed with its plane of symmetry coinciding with the first said plane, this third shell containing a propulsion unit of the assembly which is provided in known manner with diving ailerons at the front and steering and diving governors at the rear, these governors being adapted to be controlled simultaneously by the two divers acting manually in known manner on the device controlling the ailerons at the front, and the other diving means at the rear, and with the feet on the steering means of the vessel.

The description of one embodiment of such a vessel,
At the front, the arrangement of the depth ailerons or hydroplanes is of the differential control type in a manner known per se and comprises a single aileron of horizontal axis disposed externally on the outer side of each torpedo shell relatively to the assembly on the two shells.

These ailerons or hydroplanes are indicated at 31a and 31b respectively in Figure 3 and are actuated differentially in known manner by a shaft 37 such as that shaft by means of a fork forming a control stick 30 with two handles 32a and 32b, which are gripped by the two divers respectively.

This control stick 30 is fixed to a U-shaped member 33 (Figures 7 and 8) which is pivoted about an axis in the plane of symmetry provided by journal screws 34 formed with shoulders and screwed with interposed washers 35 into a transverse sleeve 36 which itself turns about the cylindrical part 37 of the pin of the hydroplane 31b, which is provided with a fork 38d for fixing the said hydroplane and a shoulder 39b.

This cylindrical shaft 37 is journaled in a tubular part 41 welded transversely on the shell 1b.

This tubular part 41 is disposed with its outer end 42 serving as a stop for the shoulder 39b on the one hand and with its inner end 43 serving as a stop, except for clearances, for the sleeve 36 turning on the shaft 37 which supports it.

After having traversed the ring 36, the extension of the shaft 37 serves as a pivot for a sleeve 44 which enclosed it and holds the ring 36 (Figure 6) except for longitudinal play.

The sleeve 44 is held so that it is free to turn on the shaft 37 by headed screws 45 screwed into this sleeve, the heads of the screws penetrating without being jammed into a circular groove 46 formed in the shaft 37 towards the end thereof. The sleeve 44 is extended coaxially by the pin 47 of the hydroplane 31a which journals in a tubular member 48 forming a bearing and welded on the shell 1b. Above the shoulder 49 of the shaft 47 and an external stop ring 51 held by a pin on the shaft 47.

Towards the rear end, the U-shaped member carries fixed on its surface an elongated plate 52 forming a beam or bar oscillating about the shouldered screw 34 and carrying at its ends opposed and symmetrical slide slots 53a and 53b with an axis perpendicular to the axis of symmetry of the double control stick 30.

Sliding in the slideways 53a and 53b are rectangular cages 54a and 54b, respectively, provided with upper and lower guide grooves in contact with the straight guiding portions of the corresponding slideways 53a and 53b. The rectangular cages 54a and 54b each carry a swivel joint 55a and 55b, respectively, so as to rotate therein. These swivel joints are formed with a bore into which extend freely, with reduced clearance, cylindrical fingers 56a and 56b, respectively, with a shoulder and threaded extension.

The finger 56a is screwed and locked by its shoulders in a radial hole of the sleeve 44, with which it is thus fast without contacting the shaft 37. The finger 56b is fixed in a similar manner on and through the shaft 37. Disposed in a plane symmetrical with the plane in which 56b turns about the shaft 37 in relation to the plane of symmetry of the assembly, the finger 56b passes with its cylindrical portion into a sector-shaped slot 57 formed through the wall of the fixed tubular part 41 so as to permit a sufficient circular displacement of the said finger, driving the shaft 37 in the reverse direction.

The manner of operation is clear. When the double control stick 30 is inclined from front to rear or vice versa along the sector indicated by the arrow 40 (Figure 8), the rotation of the plate 52 not turning about the shaft 34 causes the shafts 37 and 47 and thus the hydroplanes 31a and 31b to rotate about equal angles and in the same direction.

On the contrary, the transverse rotation according to the sector of arrows 59 (Figure 6) by 30 and 33 driving the bar 52 about the same fixed axis 34, causes for example a downward rotation of the shaft 37 and an equal rotation in the upward direction of the shaft 47, with consequently equal and opposite inclinations of the respective cheeks of the hydroplanes 31a and 31b.

Any displacements of the control stick 30 will impart to the two hydroplanes inclinations about their axes, the differential result of components of rotation in the two longitudinal and transverse rectangular planes, received by the control stick 30.

In order to obtain the conjugation in rotation in opposite directions of the hydroplanes 31a, 31b and of the plane 24 of the rear depth governor or hydroplane under the influence of the longitudinal components of the displacements of the double control stick 30 about the shaft 37, a connecting rod 58 is operated, this acting on a lever 59 connected by cables 60 to a lever 62 giving a rotational movement to the plane 24, by pivoting it on a shaft extending through a hole 61 in the end of a part 62 fast with the rotating sleeve 36 (Figure 3).

The end of the part 62 carrying the hole 61 is cranked and arranged so as to provide in the suitable transverse plane a lever having its axis at right angles to the axis of 37 and driving the connecting rod 58 under the sole influence of the rotations of the sleeve about the axis 37.

The movement of the rocker bars 12 is conjugated by the passage of an endless cable 63, which is wound around the pulleys 13 and, between these latter, by the run of the cable to the rear of these pulleys, on a fixed receiving pulley 64 turning with its shaft in the plane of symmetry of the apparatus on the shell 16 and connected for example by a rod 65 disposed between an arm 66 fast with the pulley 64 and a lever 67 keyed on the shaft 21 of the check 22 of the steering governor (Figure 5).

A loose return pulley 68, the shaft of which is fixed parallel to and in front of that of the pulley 64 on the shell 16 permits at the same time as a displacement of the bars toward the front of their axes of rotation, the free return of the feel of the divers without contacting the front run of the cable 63 connected to the pulleys 13.

The shells 1a and 1b will be able to serve as storage means for accessories other than the motor contained in the shell 16, more especially propulsion accumulators in the general case where this motor is an electric motor. They may contain all other accessories of the submarine vessel or equipment carried by it and carry all the control members not shown herein, connections by insulated cables or fluid-tight tubes being provided between these lateral shells and the central shell.

Without departing from the invention, many modifications can be incorporated into the embodiment of such a two-seater submarine vessel, while remaining within the scope thereof. Instead of the double control stick which has been described, it is possible to use two control sticks connected to one another, for example, by a deformable parallelogram device for connecting them in their transverse movements. In any known manner, one of the control parts on which the hand of the pupil can act and of the control system by rudder bars actuated by the said pupil can be disconnected from this control system by the instructor in order that the latter ensures that he alone is in control. It will also be possible to provide the shutting-off of the motor controls which normally will be actuated by each of the two divers. These arrangements are especially to be provided in the case where the second diver is essentially only a passenger for a journey or a submarine exploration, but is not a trainee pilot or a second pilot.
What I claim is:

1. A first and second seater submarine vessel comprising two streamlined shells each adapted to be mounted by a diver, means interconnecting said shells at the rear end thereof, a third streamlined shell disposed between said two shells at the rear end thereof, means connecting said third shell with said two shells, propulsion means disposed in said third shell, hydroplanes mounted at the front of said vessel, steering and diving planes mounted at the rear of said vessel, common manually operable control means coupled to said hydroplanes and said diving planes and common operating pedals coupled to said steering planes, said interconnecting means having end portions shaped partially to embrace said shells, fixing clips encircling said shells and said end portions and adapted to be tightened whereby said end portions are clamped against said shells.

2. A two-seater submarine vessel comprising first and second streamlined shells each adapted to be mounted by a diver, means interconnecting said shells at the front end thereof, a third streamlined shell disposed between said two shells at the rear end thereof, means connecting said third shell with said two shells, propulsion means disposed in said third shell, hydroplanes mounted at the front of said vessel, steering and diving planes mounted at the rear of said vessel, common manually operable control means coupled to said hydroplanes and said diving planes and common operating pedals coupled to said steering planes, said interconnecting means comprising a pair of shoes, each adapted respectively to embrace partially one of said first and second shells and said third shell, cross members interconnecting said shoes and fixing clips encircling said shoes and said first and second shells.

3. A vessel as described in claim 2, said support means comprising bicycle-saddles disposed transversely of said first and second shells, the narrower portion of said saddles being directed toward said first and second shells.

4. A two-seater submarine vessel comprising first and second streamlined shells each adapted to be mounted by a diver, means interconnecting said shells at the front end thereof, a third streamlined shell disposed between said two shells at the rear end thereof, means connecting said third shell with said two shells, propulsion means disposed in said third shell, hydroplanes mounted at the front of said vessel, steering and diving planes mounted at the rear of said vessel, common manually operable control means coupled to said hydroplanes and said diving planes and common operating pedals coupled to said steering planes, said interconnecting means.

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