Dec. 29, 1959 D. I. REBIKOFF 2,918,889

CONTROL MEANS FOR UNDERWATER VEHICLE

Filed June 18, 1956

Fig. 1.

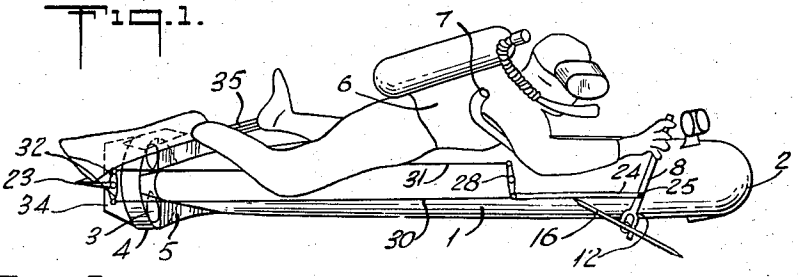


Fig. 2.

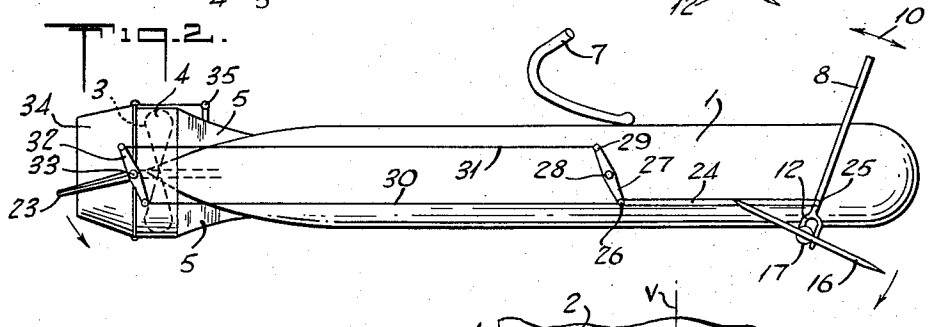


Fig. 3.

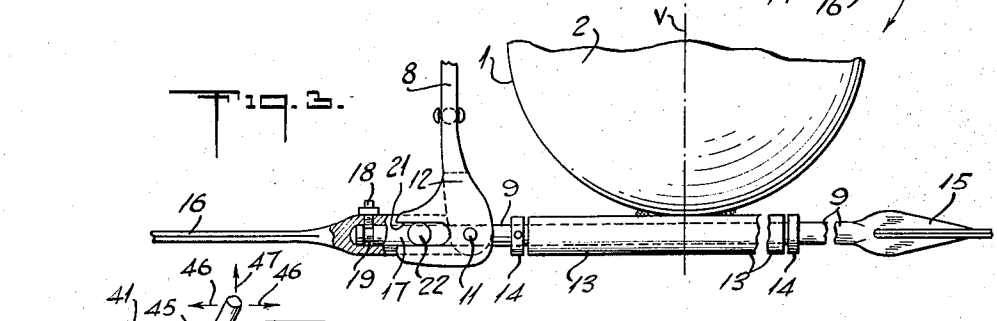


Fig. 4.

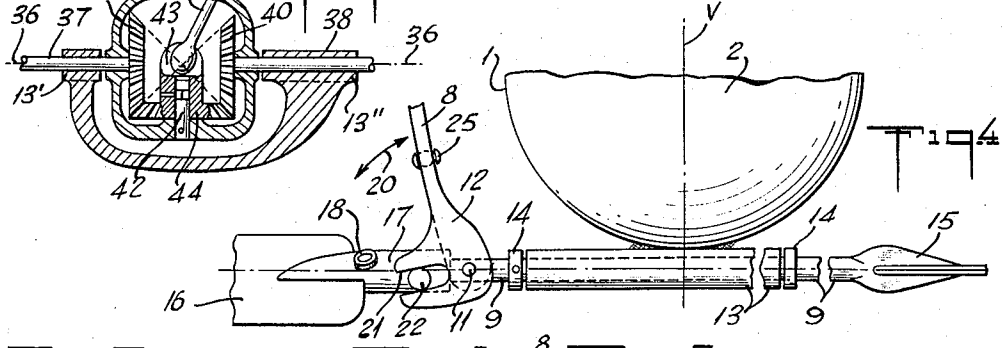


Fig. 5.

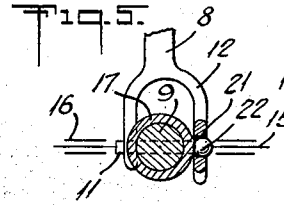


Fig. 6.

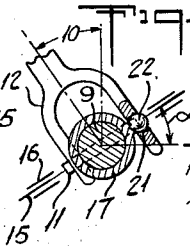
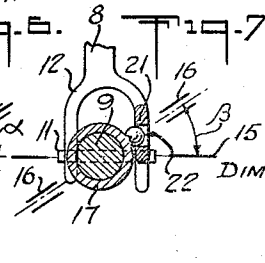


Fig. 7.



INVENTOR
DIMITRI ISSAIEWITCH REBIKOFF
BY Stanley Wolder
ATTORNEY

United States Patent Office

2,918,889

Patented Dec. 29, 1959

2,918,889

CONTROL MEANS FOR UNDERWATER VEHICLE

Dimitri Issaiewitch Rebikoff, Cannes, France, assignor to Cinefot International Corporation, New York County, N.Y., a corporation of New York

Application June 18, 1956, Serial No. 591,952

Claims priority, application France December 7, 1955

2 Claims. (Cl. 114—16)

The present invention relates to means for controlling undersea craft such as submarines, torpedoes bearing photographic and similar equipment, and the like, and in particular to such means as may be operated by a single individual.

In the case of smaller submarine craft such as "mini-subs," the length of the vehicle does not exceed a few meters and in a sense the personnel is identified with the vehicle. This is also true with reference to torpedoes for photographic work, i.e. those wherein lights and cameras are installed in forward portions of such torpedoes, and propulsion, steering and diving means are provided, and wherein the crew or operator ride outside of the torpedo. In such cases gravity forces are practically set off by Archimedean pressures.

In both types of vehicles the control means presently to be described enable rapid changes in direction of an order not possible with conventional submarines, and would appear to be of great use both to the military and those engaged in sports.

In submarines in particular, wherein forward and rear planes or diving fins are employed to effect vertical displacement, and a rudder is employed to effect horizontal displacement, transversely disposed planes, such as a pair of forward or front planes, are usually inclined or elevated simultaneously and generally are inclined or elevated to substantially the same degree. Operation of the submarine is usually carried out by three men who comply with the orders of a commander, one of them continuously observing bearing, another depth and the third the ship's balance.

A primary object of the present invention is to enable a single individual, by operation of a single control stick, to fully and readily direct the movements of an undersea craft and in this fashion to fully exploit the capabilities of the craft in connection with all of its possible movements. These are similar to the maneuvers of an airplane in the atmosphere and include loops, spins, turnings of all kinds, dives, inverted flying, and the like.

In its preferred form the present invention comprises two front or forward fins or planes extending hoizontally from opposed forward sides of the vehicle, the same being disposed symmetrically about the longitudinal axis of the vehicle and normal thereto, the planes in the rest position being parallel with one another, and their broader sides lined parallel with lines substantially in the horizontal plane which cuts through the longitudinal axis of the vehicle; said planes being mounted on shafts and means connected to said shafts to enable the simultaneous rotation thereof, including a control stick, and means operating through a differential likewise connected with said control stick to cause differential rotation of said shafts; said control stick also being connected to an aft or rear fin or plane in such fashion that when the shafts bearing said forward planes are rotated simultaneously in a given direction the shaft connecting said rear plane is caused to rotate in a direction of opposite sign.

Other objects and a fuller understanding of the present invention may be had by referring to the following expanded description and claims, taken in conjunction with the accompanying drawing which illustrates preferred embodiments thereof, it being understood that the foregoing statement of the objects of the subject invention and the brief summary thereof are intended to generally explain the same without limiting it in any manner.

Fig. 1 is a side perspective view of an operator astride a torpedo for photographic purposes, embodying the present invention.

Fig. 2 is a side elevation of said torpedo.

Fig. 3 is a fragmentary front elevation thereof, a portion of the socket bearing the moveable forward plane being broken away, the forward planes being shown in the rest or normal position.

Fig. 4 is a similar front elevation thereof, the planes being shown in position to turn the vehicle to the operator's right.

Fig. 5 is a fragmentary section along 5—5 of Fig. 3 treated as though there were no broken away portion, the forward planes being shown schematically.

Fig. 6 is a similar view in which the planes are shown equally inclined for the purposes of elevating the vehicle without turning.

Fig. 7 is a similar view thereof in which forward edge of the movable plane is elevated to enable a turn to the left.

Fig. 8 is a cross-sectional elevation, with parts in perspective, of another form of differential which may be employed.

Referring to the drawing and in particular to the preferred form of the present invention illustrated in Figs. 1–7 it comprises a torpedo **1** of the type which is used for undersea photography, and which may incorporate in its nose (not shown) lighting and camera means as well as contain propulsion equipment such as an electric motor and silver batteries to drive the same. The torpedo is rounded at the front **2** and is driven by a propeller **3** which is enclosed by a safety ring **4** affixed to ribs **5** which act as a fixed empennage. Such a torpedo, of course may be ridden by an operator **6** equipped for free driving, the operator riding on his stomach over the torpedo, the upper part of his body lying over and contacting a generally V-shaped support which is in the shape of a bicycle or motorcycle handlebar. Positioned conveniently to the operator is a control stick **8** which is a lever connected to a rocker shaft **9** so as to be pivotable in arcuate direction **10** which lies in a plane parallel to the longitudinal axis of the torpedo, the lower portion of said stick comprising a fork **12** which is positioned about said lower shaft **9** and mounted thereto by a pin **11** which passes through aligned apertures in the tines of the said fork and said shaft. Said rocker shaft itself is rotatably mounted to the torpedo by a sleeve bearing **13**, the upper portion of which is affixed to the underside of the torpedo, the shaft being secured against lateral displacement by ring detents **14** keyed to said shaft on either side of said bearing.

Attached to said shaft at one end is a left forward or front fin or plane **15** and secured to the other end is another such plane **16** which is mounted at such end by means of a socket **17** through which is passed a set screw **18** which extends into a radial groove **19** proximate said end of shaft **9**, so as to retain said socket and plane **16** in rotatable connection with said shaft. The front tine of fork **12** is elbowed to provide a lateral extension which contains a slot **21** extending inwardly from the free end of said extension. A wrist pin **22** extends radially outward from socket **17** so as to lie within slot **21**. Hence, as control stick **8** is pivoted laterally in direction **20**, which lies in a plane perpendicular to the longitudinal

axis of the torpedo, wrist pin 22 is driven by the inside surfaces of slot 21 in a plane which lies parallel to said longitudinal axis, causing socket 17, and with it plane 16, to be similarly rotated. By this means plane 16 may be rotated independently of plane 15.

There is affixed to control stick 8 a connecting rod 24 by means of a pivot pin 25, the other end of said rod being pivotally connected to the lower end 26 of a lever 27 which is connected by a pivot pin 28 to the body of the torpedo. To the upper end 29 of said lever 27 there is affixed a piano wire 30 and similarly to the lower end 26 thereof there is affixed a piano wire 31, said wires leading rearwardly to and being connected to the corresponding ends of a lever 32, keyed to a transversely extending shaft 33 so as to be angularly displaceable in synchronization with lever 27, along a portion of the length of which there is affixed aft or rear fin or plane 23.

To complete the control means there is a conventional rudder 34 to which is attached a transversely extending rudder bar operable by the operator's feet in the form shown. Of course, a hydraulic or electric motor means might be provided to displace the rudder in control synchronization with the lateral displacement of control stick 8, i.e. so that as such lateral displacement of the control stick causes the vehicle to bank the rudder would be turned in the appropriate direction.

The banking and diving mechanism operates in the following manner. In the rest position shown in Figs. 3 and 5, front planes 15 and 16 extend horizontally at right angles to the vehicle's vertical plane and are parallel to one another. If it is desired to cause the vehicle to rise, the operator pulls backward on control stick 8, thus rotating shaft 9 backwardly and causing the trailing edges of planes 15 and 16 to be depressed, the angular displacement being indicated by α in Fig. 6. Such backward motion of control stick 8 in direction 10 will likewise cause the trailing edges of rear plane 23 to be elevated through the linkage of rod 24, piano wires 30 and 31, and levers 27 and 32, thus complementing the action of the forward planes and pointing the vehicle in an upward direction.

Of course, a movement of control stick 8 to its forward extreme will cause angular rotation of the appropriate shafts of the opposite sign and hence will point the vehicle in a downward direction.

The banking of the vehicle is brought about when control stick 8 is laterally displaced in direction 20. If, for instance, it is pulled inwardly then the leading edge of fin 16 will be elevated relative to plane 15, the angle of displacement being the angle β (see Fig. 7). Plane 16 will therefore tend to rise and to bank the vehicle so that plane 16 lies higher than plane 15. The reverse occurs when the control stick 8 is displaced outwardly (see Fig. 4).

A modified form of differential means is illustrated in Fig. 8. In this example there is positioned along what was the longitudinal axis of rocker shaft 9 and is here designated 36, shafts 37 and 38 which are journalled in sleeve bearings 13' and 13'', respectively, the outer ends of said shafts bearing, respectively, planes 16 and 15, and on their inner ends driven beveled gears 39 and 40, respectively, said gears being enclosed in a housing 41 through the walls of which said shafts are likewise journalled. An axle 42 is supported upright from the bottom of housing 41 and there is journalled thereon a hub 43, to which is attached toward the bottom a driver bevel gear 44, which meshes with the driven bevel gears 39 and 40. Attached to said hub is a control stick 45. By reason of the differential gear system just described, after control stick 45 is displaced in direction 46, hub 43, and with it driver bevel gear 44, will be rotated causing driven bevel gears 39 and 40, which carry respectively front planes

16 and 15, to be rotated in opposite directions. If this movement was from the rest position, it would, of course, then cause the vehicle to bank sharply. On the other hand, if control stick 45 is displaced in direction 47 then there will be no relative rotation between any of the gears and shafts 37 and 38, and with them front planes 16 and 15, respectively, will be rotated simultaneously and cause the front of the vehicle to be elevated or displaced depending upon whether said control stick was pulled upwardly or pushed downwardly, respectively.

The connections shown by the various control surfaces have been substantially mechanical linkages. The control stick may be linked by conventional hydraulic motors or distributors to the control surfaces. Similarly, instead of hydraulic motors, electric motors or activators may be employed.

Although the subject invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous additions and changes in the details of construction, combination and arrangement may be resorted to without transcending the scope of the invention as hereinafter claimed.

What is claimed is:

1. In an undersea craft having a body, control means comprising a bearing affixed to said body, a rocker shaft journalled in said bearing rotatable along an axis perpendicular to the longitudinal axis of said body, a fixed plane carried by said shaft at one end thereof extending laterally therefrom, a socket rotatably secured to said shaft at the other end thereof having the same axis of rotation as said shaft, a first movable plane carried by said socket at the free end thereof laterally extending therefrom, said planes normally lying in parallel relationship, the transverse axes of said planes being parallel in a rest position, a control stick pivotally secured to said shaft proximate said socket rotatable along a path in a plane parallel to the axis of rotation of such shaft, a crank extension of said stick extending parallel to said axis of rotation along said socket, said extension having a slot therein, a wrist pin connected to and extending outwardly from said socket in engagement with the walls of said slot, whereby upon displacement of said stick in a direction normal to the axis of rotation of said shaft said planes will be equally angularly rotated, and upon displacement of said stick in a direction parallel to said axis of rotation of said shaft said movable plane will be angularly displaced relative said fixed plane.

2. Control means as described in claim 1, a second movable plane rotatably mounted to said body, spaced from said fixed and first movable planes, secured to said body to rotate about an axis parallel to the axis of rotation of said shaft, and means connected to said control stick and said second movable plane to simultaneously angularly displace said second movable plane in an angular direction opposite to that followed by said fixed and first movable planes when said stick is moved along a path perpendicular to the axis of rotation of said shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

1,125,772	Ullin	Jan. 19, 1915
1,187,738	Janney	June 20, 1916
1,232,241	Diamond	July 13, 1917
2,369,859	Sargeant	Feb. 20, 1945
2,722,021	Keogh-Dwyer	Nov. 1, 1955
2,823,636	Gongwer et al.	Feb. 18, 1958

FOREIGN PATENTS

643,528	France	May 16, 1928