VARIABLE BUOYANCY UNDERWATER MISSILE

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to self-propelled device, and particularly to pliable, underwater explosive projectiles.

An object of this invention is to provide projectiles of the aforesaid type with a new and improved propulsion system.

A further object in this connection is to provide such a projectile with the ability to intermittently and automatically change the depth at which it moves.

Another object is to provide a projectile which is moved in water by the reaction of water ejected from it.

The manner in which the invention achieves these and other objectives will be apparent from the following specification taken in connection with the accompanying drawing in which:

FIG. 1 is a view of the device with a part broken away along its longitudinal section to better show its construction.

FIG. 2 is a schematic elevation showing the movement of the device.

FIG. 3 is a plan view showing a pattern in which a number of the devices can be utilized.

Broadly, the invention is adapted for utilization as a torpedo-mine intended for attacking surface and underwater vessels. It is hurled from a torpedo tube or dropped from a craft into the water. After the ejecting force is exhausted, the device moves under its own power in a preset direction, normally toward enemy waters. While doing so, it intermittently changes the level at which it moves, horizontally as well as vertically. When its fuel is spent, it sinks to the bottom and lies in wait as a mine. It thus acts as a torpedo while moving, and as a mine when stationary.

Referring to the drawing, the self-propelled vehicle is indicated by the reference numeral 10. Its body is somewhat cylindrical in shape, resembling a torpedo, and comprises three sections. The head 12, the foremost section, has a cavity 13 holding a pour-in charge of high explosive 14, for instance, torpex. Normally an exploder mechanism corresponding to a bomb fuse or similar device operating by acoustic, magnetic, or hydrostatic action is incorporated in the war head for setting off the explosive charge 14. Since the exploder mechanism is not considered to be a part of this invention, details of its construction are not given. Threaded or otherwise suitably secured to the trailing end of the forward section 12 is a buoyancy tank or mid-section 16 which in turn is similarly joined to a tail section 18.

The buoyancy tank 16 is designed for the admission and expulsion of water whereby the specific gravity of the vehicle is varied so that it may have a peripheral wall 19 closed at its aft end by a fixed wall 20, defining within, together with end wall 21 of forward section 12, a buoyancy chamber 22. A vent valve assembly 26 is mounted in the upper side of wall 21 which serves as an outlet for venting gaseous material from within chamber 22. On wall 19 there is a hole 24 with an external tubular nozzle 25 leading rearwardly from it for passing water into and out from chamber 22.

Vent valve assembly 26 is removably threaded into wall 19 and has vertically disposed cup-like body 27 with an inlet 28 at its top and outlets 29 and 30, near its bottom. A reciprocable valve member 31 seats on inlet 28 and is secured to the inner surface of the bottom of valve body 27 by an evacuated bellows 32. A spring 34, guided by opposed projections extending from valve 30 and the bottom of valve body 27 normally urges valve member 31 to an open position. Pressure of the water external of the vehicle seats valve member 30 and seals inlet 28.

Water in chamber 22 is expelled from nozzle 25 by gas pressure developed in the tail section 18 and conducted to chamber 22 by a conduit 36 which terminates forward of fixed wall 20. Tail section 16 is similar in general appearances to mid-section 16. It is closed at its aft end by an end wall 38 with a central depression 39. Within, it has a fixed partition 42 spaced forward of end wall 38 and a movable wall or piston 43 placed ahead of that. The area within the tail section is thus divided into axially aligned portions which are termed a pressure flask 44, a fuel tank 46, and a mechanism compartment 48. Conduit 36 passes through flask 44 and tank 46 and terminates in compartment 48. Piston 42 is reciprocably mounted on conduit 36 and has a forwardly extending hub 41 which keeps it separated from wall 20 of the mid-section.

A suitable high pressure is developed in flask 44 by precharging the flask from a source (not shown in the drawing) of pressurized gas such as air or nitrogen or the like. Valve assembly 50, which allows ingress but denies egress to flask 44, is constructed in the manner shown in the drawing or in the manner any other standard form of high pressure gaseous charging valve is constructed. The valve assembly 50 as shown is removably secured in the upper side of the peripheral wall forming the tail section just aft of the joint made with the mid-section. Its valve 52 is normally urged outwardly by a spring 54 to close the inlet port 56 against the escape of gas from flask 44.

Fuel tank 46, which is between pressure flask 44 and compartment 48, houses piston 43 with pressure flask 44 for one of its walls. It carries a fuel which is readily subject to gasification and in this embodiment hydrogen peroxide is preferred. The pressure on piston 42 urges the fuel rearwardly thereby placing it under pressure.

Decomposition or gasification of the hydrogen peroxide is obtained by a catalyst in the form of a silver screen 58 which is disposed in the aft end of tube 36.

A pipe 60 extending from a hole 61 in partition 40 connects fuel tank 46 to catalyst screen 58 by way of a solenoid control valve 62. The latter is normally held closed by a spring 64. It is opened upon energization of its coil 66 with closing of a pressure switch 70 mounted in the external depression 39 in end wall 38 which connects it to a source of energy 72. Pressure switch 70 is of the spring bellows type having contacts 71 that are normally open and come together when an external water pressure compresses the bellows.

In use, the vehicle is launched by ejecting it from a torpedo tube or dropped into the water from a vessel or aircraft. It does not sink to the bottom because it is designed with a positive buoyancy. At this time, the vehicle being at the surface of the water, there is no pressure on any of the valves nor is there gas or water in buoyancy chamber 22. Water fills chamber 22 through nozzle 25 and valve 30 causing the vehicle to dive to a level determined by its buoyancy. At this level, the water pressure is such that vent valve 30 and pressure switch 70 are closed. Solenoid coil 66 becomes energized and the solenoid control valve is opened. This allows the fuel, hydrogen peroxide, to pass by the open control valve 64.
and through the catalyst screen 58 where it is decomposed. The resulting gas enters buoyancy tank 22 through conduit 36 and forces water from the tank out nozzle 25. The reaction of the escaping water causes the vehicle to move forward.

As the water is expelled from buoyancy tank 22, the specific gravity of the vehicle is decreased and it rises toward the surface where vent valve 30 opens and allows the gas to escape. Water enters the buoyancy tank through nozzle 25 whereupon the cycle described is repeated. In this manner (FIG. 2) the vehicle dives to a set depth and ascends while advancing forward until it strikes a target or its fuel is exhausted. In the case where its fuel is exhausted, it sinks to the bottom and acts like a mine.

The device may be released from a safe distance and advanced into enemy waters. The changes in level in its forward movement provides it with the possibility of striking a surface as well as an underwater craft.

A steering mechanism is shown in the form of fixed external fins 76. These may be angled to cause the vehicle to move in a circle. Such use permits it to accomplish the task of a depth charge dropped from a moving vessel. FIG. 3 shows the latter use where a number of the vehicles 10 are ejected toward a target T from the side of a vessel V moving in the direction A with their fins angled so that they make circular paths P.

Obviously a more complex steering mechanism, similar to that employed in torpedos, may be installed. Likewise, different fuels, lithium and water, calcium carbide and water, etc., may be used to force the water from the buoyancy tank 22.

While the invention has been shown in a preferred form, it is to be understood that various changes and modifications may be made by those skilled in the art without departing from the principles of the invention, the scope of which is to be determined by the appended claims.

What is claimed and desired to be protected by Letters Patent is:

1. In a submarine floating body designed for oscillating between predetermined depths of submersion while moving forwardly, a buoyancy chamber having ballast water therein, a nozzle associated with said chamber for the passage of water into and out of said chamber, a source of pressurized gas, an injector conduit interconnecting said source with said chamber for expelling water therefrom, pressure responsive means associated with said chamber for venting thereof with decreased external water pressure, and means responsive to external water pressure permitting the flow of pressurized gas to said tank with increased water pressure and denying flow with decreased external water pressure.

2. In a self-propelled underwater vehicle, the combination of a buoyancy chamber having a nozzle for the admission into and ejection therefrom of water, pressure responsive means associated with said chamber for venting thereof at a predetermined decreased external water pressure, a tank containing a liquid fuel adapted to be gasified by a catalyst, an injector conduit interconnecting said tank and said chamber, catalyst means in said injector conduit, and means responsive to change in external water pressure for permitting the flow of gasified fuel from said tank through said catalyst and to said chamber at a predetermined increased external water pressure.

3. The device of claim 1 wherein said fuel is hydrogen peroxide and said catalyst is a silver coated screen.

4. The device of claim 2 including a piston slidably mounted in said tank, said fuel being disposed on one side of said piston, and means in said tank on the other side of said piston for the admission of a pressurized gas whereby said piston is subjected to the force thereof and said fuel is thereby pressurized.

5. In a self-propelled underwater projectile, a head adapted to receive an explosive with an exploder, a closed end buoyancy tank secured to the trailing end of said head, a nozzle associated with said tank for passage of water into and out of said tank, a check valve in said tank for venting thereof at a predetermined decreased external water pressure, a closed end hollow tail section secured to the trailing end of said buoyancy tank, an injector conduit interconnecting said buoyancy tank and said tail section, a slidable piston mounted in said tail section, a source of gas on one side of said piston, means in said tail section on the other side of said piston for the admission of a pressurized gas whereby said piston is subjected to the force thereof and said gas is thereby pressurized, valve means in said conduit, and pressure responsive means associated with said valve pressure whereby gas flows through said conduit into said buoyancy tank.

6. The projectile of claim 5 including fins externally secured to said tail section for guidance thereof.

7. The projectile of claim 6 wherein said source of gas is raw hydrogen peroxide, and including a silver screen catalyst in said conduit for decomposing thereof when said valve is opened.

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