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 a missile launching system and more particularly to a system for launching missiles from below the surface of the water.

One of the chief advantages of the polaris submarine-missile system is the great invulnerability of the launching base which is the submarine. However, investigation of means for neutralizing a similar enemy system indicates that defense systems which would materially reduce the usual effectiveness of the polaris system are feasible. For example, when a missile is launched from a submarine, high-flying aircraft may detect the missile course and extrapolate back to the launching location and subsequently attack the launching submarine with long range nuclear tipped missiles. Thus, it is conceivable that the submarine may be destroyed after it has launched a relatively small fraction of its missile load. Such a defense system relies on the proximity of the submarine to the missile when it breaches the surface of the water.

The present invention contemplates a launching system in which the missile carrying submarine is separated by a great distance from the missile at the time the missile is launched and breaks the water surface. Thus, enemy anti-submarine missiles aimed at the missile breach point using nuclear explosives are ineffective to destroy the submarine which at the time the missile breaks the surface of the water is many miles away.

The present invention contemplates a missile launching system wherein a capsule containing the missile is ejected from the vertical tube of the conventional missile launching submarine. The capsule rises to a predetermined depth wherein it remains for a predetermined time. At the expiration of this time which permits the submarine to escape from the launch area the capsule rapidly rises and breaks the water surface and as the capsule is in mid-air, the missile is fired.

Aside from the advantage of increasing launching submarine security other advantages are attendant to this system. Utilizing this system missiles may be launched from depths of 1000 feet or more, simultaneous launching of all 16 missiles is possible, missiles may be launched from the submarine while it is still underwaer, and the contemplated launching system is compatible with the conventional launching system in use.

Therefore, it is an object of the present invention to provide an underwater missile launching system wherein the missile carrying submarine may be a great distance from the launch area at the time the missile is launched.

Another object of the present invention is to provide an underwater missile launching system wherein there is a predetermined time lapse between the missile's leaving the submarine and the missile's breaching the surface of the water.

A further object of the present invention is to provide an underwater missile launching system wherein the missiles are dispensed from the submarine by floating away therefrom prior to actual launching from a predetermined depth.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same become better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIG. 1 shows a view in section of a preferred embodiment of the invention as it appears in a conventional vertical submarine launching tube.

FIG. 2 shows the valve arrangement of FIG. 1.

FIG. 3 illustrates the capsule after it has left the submarine vertical tube and just before it breaks the surface of the water.

Referring now to FIG. 1 there is shown a submarine launching tube 11 having an opening 12 at the bottom extremity thereof. The tube 11 is similar to the conventional type found in missile launching submarines. The opening 12 serves as a conduit through which sea water may be pumped into space A. The tube 11 contains an enlarged hollow cylindrical capsule made of any suitable metallic material. The capsule 13 contains the missile 14. The missile 14 rests on projections 13a and 13b within the capsule 13. The capsule rests on projections 11a and 11b within the tube 11. An inflatable boot or tube 17 encircles the upper extremity of the capsule 14 and is fixedly secured thereto. Accumulators 18 of which there may be more than two are secured on the inner periphery of the capsule 14 and store air under pressure. The air in the accumulators 18 is supplied to valve arrangement 21 via manifold 19 and conduit 20. Valve 21 controllably inflates tube 17 via conduit 16 in a manner to be more fully discussed in relation with FIG. 2.

Capsule 13 is further comprised of a tube portion 22 which is telescoped over the outside periphery of capsule 13 and which is secured thereto by frangible rods 23. When it is desired to dispense the missile carrying capsule from the tube 11, sea water is pumped into chamber A through opening 12 and the nose and body portion of the capsule is forced out of the tube 11. As the capsule is leaving tube 11 projection 31 actuates switch or lever 32 which extends from the capsule. The actuation of lever 32 causes the supply of air under pressure from accumulators 18 to inflate tube 17. Depending on the amount of inflation of tube 17 the capsule will float up and away from the submarine to a predetermined depth below the surface of the water and dwell there. The buoyancy of the capsule 13 is controlled by the particular arrangement of valve mechanism to be more fully discussed below.

The end of capsule 13 has securely attached thereto a high-load type of powder chamber 24 having an orifice 25 which opens to the space B between the capsule 13 and the telescoping member 22. Reference numeral 27 represents an igniter timer mechanism which may be initiated by the actuation of lever 32 on the capsule's being dispensed from the tube 11. The chamber 24 contains a cake 26 of propellant power which is detonated by the igniter timer mechanism 27 a predetermined time after the capsule has left tube 11.

Therefore, the capsule after dwelling at a predetermined depth for a predetermined time has in the telescoping portion 22 a means for rapidly increasing its buoyancy a substantial amount. Thus, when igniter timer mechanism 27 sets off the cake 26 of propellant the telescoping portion 22 is forced into its lowest position as seen in FIG. 3 increasing the volume of the capsule by about 75 percent. When this occurs enough buoyancy has been added
to the capsule to cause it to rapidly rise and break the surface of the water at a speed of about 65 f.p.s. To reduce drag during this phase of the operation tube 17 may be deflated. Upon breaking the surface of the water the arrangement of primacond 28 and explosive bolt 29 causes the capsule head to be removed and cleared out of the way of the missile path. The missile motor is then initiated. Suitable means may be provided to sink the capsule in case of failure to work as anticipated.

FIG. 3 shows the capsule with the telescoping portion 22 fully extended just before a capsule broaches the surface of the water. Fins may be provided for stability.

Referring now to FIG. 2 showing the details of valve arrangement 21 for inflating tube 17 to cause the capsule to float to a predetermined depth and dwell there. Before water is forced into chamber A through opening 12, spindle 33 of valve 34 is kept to the left by high pressure air at port 35 via the air inlet, thus sealing off high pressure air to tube 17 via port 36. When the capsule begins to rise so that the collapsed tube 17 is free of the structure and the capsule is partly in the water above the submarine, the control arm or lever 32 of the valve gate 30 is forced down by projection 31. Water pressure at port 37 forces spindle 33 to the right allowing high pressure air to enter tube 17 through port 36 and nozzle 16. The air pressure in tube 17 is communicated to port 36. When the air pressure in tube 17 exceeds the water pressure, spindle 33 is forced to the left preventing additional air from entering tube 17. Tube 17 is now fully inflated due to the weight of 80 water displaced being greater than the capsule weight the capsule rises slowly at a predetermined velocity to its dwell depth.

As the capsule arrives at the water pressure decreases and the air pressure in tube 17 must be relieved or the tube 17 would burst. This is the function of valve 39. Spindle 40 is proportioned to allow air pressure in tube 17 to exceed ambient water pressure by a predetermined p.s.i. When the water pressure at port 41 drops to a predetermined p.s.i. below that of the air pressure in tube 17, piston 42 is forced to the left allowing air to escape through port 43. When the capsule reaches its dwell depth, valve 44 has the function of maintaining the capsule at the particular dwell depth. Spring 46 is designed to match the desired water pressure at the desired dwell depth. When the water pressure at port 41 falls below the desired pressure, piston 47 moves in uncovering the exhaust port at 48. Thus, air is exhausted from tube 17 which collapses the tube 17 until the capsule loses enough buoyancy so that the capsule sinks to the proper depth where port 48 will again be closed. When the capsule falls below the dwell depth, water pressure at port 37 exceeds the back pressure from tube 17 at port 38 and spindle 33 is forced to the right admitting additional air into tube 17, thereby causing the capsule to increase in buoyancy and to rise. Thus, a predetermined dwell depth may be maintained for any given capsule by presetting the various valve springs.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A system for launching a missile from a predeter-

2. Water means for increasing the buoyancy of said capsule to float said capsule to a predetermined dwell depth, tubular means telescoped over the bottom outside periphery of said capsule forming a watertight expansion chamber therewith, propellant powder means disposed within said tubular means,

3. Igniter means disposed proximate to said powder means for igniting said powder means a predetermined time after said capsule leaves the submarine whereby the buoyancy of said capsule is rapidly increased causing said capsule to catapult high into the air in a missile firing position. A system for launching a missile from a predetermined dwell depth after being dispensed from a submarine, comprising in combination:

4. An elongated cylindrical capsule containing the missile to be launched,

5. Tubular means enclosing said capsule at the upper extremity thereof,

6.空气的凝聚使得重量增加并导致浮上，从而在预定深度停留，膨胀用的气管与下部外部边缘紧密配合，构成一个水密膨胀室，附带推进剂粉末放置在所述的膨胀气管内，

7. 导火索位置在所述的推进剂粉末附近，预定的时间后点燃推进剂粉末，使所述的推进剂粉末的浮力急剧增加，导致所述的胶囊高速弹射到高空中，进入一个导弹发射位置。
said valve means including a first valve responsive to a predetermined water pressure to connect said air accumulator means to said inflatable tube means, said first valve including means responsive to a predetermined air pressure in said inflatable tube to disconnect said air accumulator means from said inflatable tube means,
a second valve responsive to a drop in water pressure below a predetermined amount to deflate said inflatable tube means an amount proportional to said drop in water pressure,
a third valve responsive to air pressure in said inflatable tube means a predetermined amount above said water pressure to deflate said inflatable tube means to maintain said capsule at a predetermined depth by controlling the buoyancy thereof, means for rapidly increasing the buoyancy of said capsule a predetermined time after said capsule has left the submarine whereby said capsule rises rapidly and breaks the surface of the water at a high rate of speed and is catapulted high into the air in a missile firing position.

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