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A VEHICLE LAUNCH ASSEMBLY FOR UNDERWATER PLATFORMS

STATEMENT OF GOVERNMENT INTEREST

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

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The invention relates to vehicle launching apparatus and is directed more particularly to a vehicle launching assembly for underwater platforms, such as submarines.

(2) Description of the Prior Art

The launching of torpedoes, mines, vertically fired weapons, countermeasures, and the like, all hereinafter referred to as "vehicles", is generally well known. Over time, a few preferred types of systems have become prominent. The existing preferred systems include turbine pump ejection systems (TPES), air turbine pump (ATP) systems, and elastomeric ejection systems (EES), with the ATP and EES gaining favor in recent submarine design and construction.

Unfortunately, the ATP launcher has proven technically complex and expensive, and requires periodic overhauls. The EES launcher requires a special recharge pump to inflate an
elastomeric bladder, and a special slide valve to control launch transients. Further, the EES elastomeric bladder material fatigues over time and requires replacement.

Thus, despite advances in the art, there still remains a need for a launcher system which is low in cost of both manufacture and maintenance, high in operational reliability, and quiet in operation, criteria not met by present ATP and EES assemblies.

**SUMMARY OF THE INVENTION**

Accordingly, an object of the invention is to provide a vehicle launch assembly for underwater platforms, which assembly comprises known and relatively non-complex components which provide economy of manufacture and maintenance, and which exhibits high reliability and acoustic advantages over the aforementioned current launch systems.

With the above and other objects in view, as will hereinafter appear, a feature of the present invention is the provision of a vehicle launch assembly for underwater platforms. The assembly includes a water tank mounted on the platform, and a plunger movably disposed in the tank and dividing the tank into first and second zones, the first zone being in communication with a water environment in which the platform is disposed, and the second zone being in communication with a launch tube inlet line mounted on the platform. An actuator is connected to the plunger and is operable to move the plunger in the tank. A triggering and reset device is provided for initiating operation
of the actuator to move the plunger in the tank to effect a
d Selected one of (1) moving the plunger to push water from the
tank second zone to the launch tube inlet line to eject a vehicle
from the launch tube, and (2) moving the plunger to enlarge the
tank second zone to draw waterthereinto from a valve in
communication with the water environment and the tank second
zone.

In accordance with a further feature of the invention, there
is provided a vehicle launch assembly for underwater platforms.
The assembly comprises a water tank mounted on the platform, a
plunger movably disposed in the tank, the plunger comprising a
rigid disc and an annular elastomeric seal fixed to a periphery
of the disc and to an internal wall of the tank. The seal is
stretchable to provide a bias on the plunger in a direction
toward the second zone for ejecting a vehicle from a launch tube.
A triggering device comprising key means retains the disc in a
stationary condition, the key means being selectively movable to
release the disc for movement in response to the bias of the
elastomeric seal on the disc. A reset device comprises a
cylinder, a drive rod extending from the cylinder and connected
to the disc, a piston fixed to the drive rod and disposed in the
cylinder, and force means in the cylinder and acting on the
piston to move the drive rod to move the disc in the tank.

In accordance with a still further feature of the invention,
there is provided a vehicle launch assembly for underwater
platforms. The assembly comprises a water tank mounted on the
platform, a plunger movably disposed in the tank, the plunger
comprising a rigid disc and an annular elastomeric seal fixed to a periphery of the disc and to an internal wall of the tank, the seal being stretchable to provide a bias on the plunger in a direction toward the second zone for ejecting a vehicle from a launch tube. A triggering device comprises key means for retaining the disc in a stationary condition, the key means being selectively movable to release the disk for movement in response to the bias of the elastomeric seal on the disc in a direction toward the second zone to effect launch of a vehicle from a launch tube. A reset device comprises a cylinder, a shaft extending from the cylinder and slidingly through the disc, a piston fixed to the shaft and disposed in the cylinder, a body fixed to the shaft in the second zone, and force means in the cylinder and acting on the piston to move the shaft to move the body into engagement with the disc to move the disc in the tank to a position wherein the disc is engageable by the key means.

The above and other features of the invention, including various novel details of construction and combinations of parts, will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be understood that the particular devices embodying the invention are shown by way of illustration only and not as limitations of the invention. The principles and features of this invention may be employed in various and numerous embodiments without departing from the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS
Reference is made to the accompanying drawings in which are shown illustrative embodiments of the invention, from which its novel features and advantages will be apparent, wherein corresponding reference characters indicate corresponding parts throughout the several views of the drawings and wherein:

FIG. 1 is a diagrammatical view of one form of vehicle launch assembly illustrative of an embodiment of the invention; and

FIGS. 2-8 are diagrammatical views of portions of alternative embodiments of vehicle launch assemblies.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, it will be seen that an illustrative launch assembly 10 may be mounted in a forward portion of a submarine 12, or other underwater platform. The submarine 12 typically is provided with a forward-most outer hull portion 14, known as the "bow dome". Proximate the base of the bow dome 14 is a pressure hull portion 16 extending athwartships and, in conjunction with bow dome 14, defining a free flood zone 18.

The launch assembly 10 includes a water tank 20, which may be mounted in free flood zone 18. A plunger 22 is disposed in tank 20 and divides the tank into first zone 24 and second zone 26. The first tank zone 24 is in communication with the free flood zone 18 by way of openings 28 in the tank 20. The free flood zone 18 is, in turn, adapted to receive water from the water environment in which the submarine 12 is disposed, as by one or more inlets 30. Thus, the tank first zone 24 is subject
to free flooding through the openings 28. The tank second zone
is in communication with a launch tube inlet line 32.

The plunger 22 includes a rigid disc 34 and a flexible and
substantially non-stretchable seal 36 fixed to a periphery of the
disc 34 and to an internal wall 38 of tank 20. The seal 36
permits movement of the disc 34 in tank 20 while maintaining
separation of tank zones 24, 26. The disc 34 preferably is
circular in configuration and the seal is annularly shaped.

The assembly further includes a check valve 40 which
interconnects the water environment with launch tube inlet line
32. As shown in FIG. 1, the check valve 40 is in communication
with water tank 20 by way of the inlet line 32. The inlet line
32 is in communication with torpedo tubes 42, 44 or other vehicle
launch conduits.

An actuator 50 may be mounted in the free flood zone 18 and
is connected to plunger 22 and is operable to move plunger 22 in
water tank 20. The actuator 50 can include a cylinder 52 in
which is disposed a piston 54 fixed to a drive rod 56 connected
to the disc 22.

A triggering and reset device 60 can be mounted within the
pressure hull 16 and may comprise a hydraulic valve 62 to
energize a selected one of a triggering hydraulic line 64 and a
resetting hydraulic line 66. Although not shown a rest position
not communicating hydraulic fluid can also be provided. The
hydraulic lines 64, 66 extend from the triggering and reset
device 60 to the actuator 50. Thus, by operation of the
bear on piston 54 in cylinder 52 to move plunger 22 in water tank 20.

In operation, a launch is initiated by an operator's actuation of the triggering and reset device 60, as by pushing a "fire" button 68, which pressurizes triggering hydraulic line 64, which, in turn, forces piston 54 toward water tank 20. The movement of piston 54 and drive rod 56 causes similar movement of plunger 22 toward the water tank second zone 26, to push water from the tank second zone 26 into the inlet line 32 and thence into selected launch tubes 42, 44. The movement of water out of tank second zone 26 closes check valve 40 and effects launch of a vehicle into the water environment.

Upon the operator's pushing a "reset" button 70, or the like, the triggering hydraulic line 64 is evacuated and the resetting hydraulic line 66 is pressurized. The piston 54 is moved so as to move plunger 22 toward the tank first zone 24, to force water out of the openings 28 to enlarge the tank second zone to draw water into the tank second zone 26 through the check valve 40.

The water tank 20 and plunger 22 are sized according to the quantity of water required for a launch. It has been found that the diameter of disc 34 should be about one half the diameter of the cylindrically shaped tank 20. The seal 36 must be large enough to permit the disc 34 to make a complete stroke. The diameter of plunger 22 preferably is large enough to accommodate a slow stroke speed, for acoustic performance, but small enough to be easily mounted in a typical platform. In a preferred
1 arrangement, the plunger 22 is provided with a diameter of about
2 six feet, which enables a two foot stroke to displace about
3 55 ft³, the necessary volume of water for a typical launch.
4
5 In FIGS. 2 and 3, it will be seen that the cylinder 52 of
6 the actuator 50 may be provided with one or more springs 72
7 exercising a bias on piston 54. Alternatively, other means, such
8 as a weight 74 (FIG. 4) may be used to exercise a similar bias.
9 In such instances, a mechanical key 76 may be used to lock the
10 drive rod 56 in place when the assembly is in "reset" mode.
11 Pushing the "fire" button 68 serves not only to flow hydraulic
12 fluid to cylinder 52, but also to release key 76 from locking
13 position. Thus, the resulting stroke of plunger 22 is powered by
14 hydraulic fluid in combination with spring power (FIGS. 2 and 3)
15 or weight created force (FIG. 4). In resetting, the hydraulic
16 force supplied to cylinder 52 must be such as to overcome the
17 force of spring 72 or weight 74.
18
19 In FIG. 5, there is illustrated an alternative embodiment in
20 which spring force is used in a firing episode, but the spring 72
21 is disposed in the tank second zone 26, interconnecting the disc
22 34 and a wall 78 of tank 20 opposed to disc 34. The manner of
23 operation of the embodiment of FIG. 5 is similar to that of the
24 embodiments of FIGS. 2-4.
25
26 In FIG. 6, there is shown an alternative embodiment in which
27 the check valve 40, or a plurality of check valves, are disposed
28 in disc 34. Check valves can be any one way fluid flow valve
29 allowing flow from first zone 24 to second zone 26 and preventing
30 flow from second zone 26 to first zone 24. When the plunger 22
is forced to move in the direction of the second zone 26, check valves 40 are closed, but when plunger 22 is moved into the "reset" mode, water from the first zone 24, that is, from the free flood zone 18, flows through disc 22 and into tank second zone 26.

In FIG. 7, there is shown an alternative embodiment in which the annular seal 36 also serves as a spring. In this embodiment, the seal 36 is of an elastomeric material having a stretch capability, such that upon release of key 76, and injection of hydraulic fluid into cylinder 52, the seal exercises a spring force on disc 34, to add to the hydraulic force in moving plunger 22 in a firing direction.

In a further alternative embodiment, shown in FIG. 8, the assembly is similar to that shown in FIG. 7, except that actuator 50 is discrete from plunger 22, the latter being "fired" by removal of key 76 from a locking position. In operation, resetting hydraulic line 66 is activated to move piston 54 in cylinder 52 to move rod 56 so that a body 80 fixed on rod 56 engages disc 34, as by engaging a complementary shaped recess 82 in the second zone face of disc 34. The rod 56 thereby moves disc 34 into position for engagement by key 76 to hold the disc in place, with the seal/spring 36 stretched to exert a launch force on the disc 34.

To execute a launch, the hydraulic line 64 is activated to move body 80 away from disc 34, which is then retained only by key 76. Upon actuation of the "fire" button, the key 76 moves
out of its locking position, releasing plunger 22 for a firing
stroke.

While the above-described vehicle launch assembly is a
unique combination of components providing operational
advantages, each of the individual components is relatively
simple and not complex or expensive to manufacture, maintain, or
replace. Thus, the assembly provides substantial cost advantages
with regard to both initial expense and maintenance expenses.
Further, the simplicity of the individual components and lack of
wearing parts provides further advantages in reliability of
operation. Still further, inasmuch as no mechanical interaction
occurs between the plunger 22 and the tank 20, no mechanical
noise is generated in a firing or resetting stroke. Even small
noises and vibrations, such as are generated by hydraulic fluid
flow, triggering a launch, and drive rod axial motion, are
minimal because there is no high speed mechanical motion. Any
such minimal mechanical noises generated have been found to fall
below the existing water flow noises.

Accordingly, the above-described launch assembly has been
found to overcome the prior art challenges of high cost of
manufacture and maintenance, troublesome reliability, and
generation of pronounced acoustic signals.

It will be understood that many additional changes in the
details, materials, and arrangement of parts, which have been
herein described and illustrated in order to explain the nature
of the invention, may be made by those skilled in the art within
the principles and scope of the invention as expressed in the appended claims.
A VEHCILE LAUNCH ASSEMBLY FOR UNDERWATER PLATFORMS

ABSTRACT OF THE DISCLOSURE

A vehicle launch assembly for underwater platforms includes a water tank mounted on the platform, and a plunger movably disposed in the tank and dividing the tank into first and second zones, the first zone being in communication with a water environment in which the platform is disposed, and the second zone being in communication with a launch tube inlet line mounted on the platform. An actuator is connected to the plunger and is operable to move the plunger in the tank. A triggering device initiates operation of the actuator, moving the plunger in the tank to push water from the tank second zone to the launch tube inlet line to eject a vehicle from the launch tube, or moving the plunger to enlarge the tank second zone to draw water thereinto from a valve in communication with the water environment and the tank.
TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN that (1) MICHAEL T. ANSAY and (2) JOSEPH A. CARREIRO, citizens of the United States of America, employees of the United States Government, and residents of (1) Exeter, County of Washington, State of Rhode Island, and (2) New Bedford, County of Bristol, Commonwealth of Massachusetts, have invented certain new and useful improvements entitled as set forth above, of which the following is a specification.

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