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1 Attorney Docket No. 79472

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A VEHICLE LAUNCH ASSEMBLY FOR UNDERWATER PLATFORMS

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STATEMENT OF GOVERNMENT INTEREST

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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.

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BACKGROUND OF THE INVENTION

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(1) Field of the Invention

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

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(2) Description of the Prior Art

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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.

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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

1 elastomeric bladder, and a special slide valve to control launch
2 transients. Further, the EES elastomeric bladder material
3 fatigues over time and requires replacement.

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

9 10 SUMMARY OF THE INVENTION

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

17 With the above and other objects in view, as will
18 hereinafter appear, a feature of the present invention is the
19 provision of a vehicle launch assembly for underwater platforms.
20 The assembly includes a water tank mounted on the platform, and a
21 plunger movably disposed in the tank and dividing the tank into
22 first and second zones, the first zone being in communication
23 with a water environment in which the platform is disposed, and
24 the second zone being in communication with a launch tube inlet
25 line mounted on the platform. An actuator is connected to the
26 plunger and is operable to move the plunger in the tank. A
27 triggering and reset device is provided for initiating operation

1 of the actuator to move the plunger in the tank to effect a
2 selected one of (1) moving the plunger to push water from the
3 tank second zone to the launch tube inlet line to eject a vehicle
4 from the launch tube, and (2) moving the plunger to enlarge the
5 tank second zone to draw water thereinto from a valve in
6 communication with the water environment and the tank second
7 zone.

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

24 In accordance with a still further feature of the invention,
25 there is provided a vehicle launch assembly for underwater
26 platforms. The assembly comprises a water tank mounted on the
27 platform, a plunger movably disposed in the tank, the plunger

1 comprising a rigid disc and an annular elastomeric seal fixed to
2 a periphery of the disc and to an internal wall of the tank, the
3 seal being stretchable to provide a bias on the plunger in a
4 direction toward the second zone for ejecting a vehicle from a
5 launch tube. A triggering device comprises key means for
6 retaining the disc in a stationary condition, the key means being
7 selectively movable to release the disk for movement in response
8 to the bias of the elastomeric seal on the disc in a direction
9 toward the second zone to effect launch of a vehicle from a
10 launch tube. A reset device comprises a cylinder, a shaft
11 extending from the cylinder and slidingly through the disc, a
12 piston fixed to the shaft and disposed in the cylinder, a body
13 fixed to the shaft in the second zone, and force means in the
14 cylinder and acting on the piston to move the shaft to move the
15 body into engagement with the disc to move the disc in the tank
16 to a position wherein the disc is engageable by the key means.

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

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BRIEF DESCRIPTION OF THE DRAWINGS

1 Reference is made to the accompanying drawings in which are
2 shown illustrative embodiments of the invention, from which its
3 novel features and advantages will be apparent, wherein
4 corresponding reference characters indicate corresponding parts
5 throughout the several views of the drawings and wherein:

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

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

11 DESCRIPTION OF THE PREFERRED EMBODIMENTS

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

19 The launch assembly 10 includes a water tank 20, which may
20 be mounted in free flood zone 18. A plunger 22 is disposed in
21 tank 20 and divides the tank into first zone 24 and second zone
22 26. The first tank zone 24 is in communication with the free
23 flood zone 18 by way of openings 28 in the tank 20. The free
24 flood zone 18 is, in turn, adapted to receive water from the
25 water environment in which the submarine 12 is disposed, as by
26 one or more inlets 30. Thus, the tank first zone 24 is subject
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1 to free flooding through the openings 28. The tank second zone
2 26 is in communication with a launch tube inlet line 32.

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

9 The assembly further includes a check valve 40 which
10 interconnects the water environment with launch tube inlet line
11 32. As shown in FIG. 1, the check valve 40 is in communication
12 with water tank 20 by way of the inlet line 32. The inlet line
13 32 is in communication with torpedo tubes 42, 44 or other vehicle
14 launch conduits.

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

20 A triggering and reset device 60 can be mounted within the
21 pressure hull 16 and may comprise a hydraulic valve 62 to
22 energize a selected one of a triggering hydraulic line 64 and a
23 resetting hydraulic line 66. Although not shown a rest position
24 not communicating hydraulic fluid can also be provided. The
25 hydraulic lines 64, 66 extend from the triggering and reset
26 device 60 to the actuator 50. Thus, by operation of the
27 triggering and reset device 60, hydraulic force may be brought to

1 bear on piston 54 in cylinder 52 to move plunger 22 in water tank
2 20.

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

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

20 The water tank 20 and plunger 22 are sized according to the
21 quantity of water required for a launch. It has been found that
22 the diameter of disc 34 should be about one half the diameter of
23 the cylindrically shaped tank 20. The seal 36 must be large
24 enough to permit the disc 34 to make a complete stroke. The
25 diameter of plunger 22 preferably is large enough to accommodate
26 a slow stroke speed, for acoustic performance, but small enough
27 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 In FIGS. 2 and 3, it will be seen that the cylinder 52 of
5 the actuator 50 may be provided with one or more springs 72
6 exercising a bias on piston 54. Alternatively, other means, such
7 as a weight 74 (FIG. 4) may be used to exercise a similar bias.
8 In such instances, a mechanical key 76 may be used to lock the
9 drive rod 56 in place when the assembly is in "reset" mode.
10 Pushing the "fire" button 68 serves not only to flow hydraulic
11 fluid to cylinder 52, but also to release key 76 from locking
12 position. Thus, the resulting stroke of plunger 22 is powered by
13 hydraulic fluid in combination with spring power (FIGS. 2 and 3)
14 or weight created force (FIG. 4). In resetting, the hydraulic
15 force supplied to cylinder 52 must be such as to overcome the
16 force of spring 72 or weight 74.

17 In FIG. 5, there is illustrated an alternative embodiment in
18 which spring force is used in a firing episode, but the spring 72
19 is disposed in the tank second zone 26, interconnecting the disc
20 34 and a wall 78 of tank 20 opposed to disc 34. The manner of
21 operation of the embodiment of FIG. 5 is similar to that of the
22 embodiments of FIGS. 2-4.

23 In FIG. 6, there is shown an alternative embodiment in which
24 the check valve 40, or a plurality of check valves, are disposed
25 in disc 34. Check valves can be any one way fluid flow valve
26 allowing flow from first zone 24 to second zone 26 and preventing
27 flow from second zone 26 to first zone 24. When the plunger 22

1 is forced to move in the direction of the second zone 26, check
2 valves 40 are closed, but when plunger 22 is moved into the
3 "reset" mode, water from the first zone 24, that is, from the
4 free flood zone 18, flows through disc 22 and into tank second
5 zone 26.

6 In FIG. 7, there is shown an alternative embodiment in which
7 the annular seal 36 also serves as a spring. In this embodiment,
8 the seal 36 is of an elastomeric material having a stretch
9 capability, such that upon release of key 76, and injection of
10 hydraulic fluid into cylinder 52, the seal exercises a spring
11 force on disc 34, to add to the hydraulic force in moving plunger
12 22 in a firing direction.

13 In a further alternative embodiment, shown in FIG. 8, the
14 assembly is similar to that shown in FIG. 7, except that actuator
15 50 is discrete from plunger 22, the latter being "fired" by
16 removal of key 76 from a locking position. In operation,
17 resetting hydraulic line 66 is activated to move piston 54 in
18 cylinder 52 to move rod 56 so that a body 80 fixed on rod 56
19 engages disc 34, as by engaging a complementary shaped recess 82
20 in the second zone face of disc 34. The rod 56 thereby moves
21 disc 34 into position for engagement by key 76 to hold the disc
22 in place, with the seal/spring 36 stretched to exert a launch
23 force on the disc 34.

24 To execute a launch, the hydraulic line 64 is activated to
25 move body 80 away from disc 34, which is then retained only by
26 key 76. Upon actuation of the "fire" button, the key 76 moves

1 out of its locking position, releasing plunger 22 for a firing
2 stroke.

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

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

23 It will be understood that many additional changes in the
24 details, materials, and arrangement of parts, which have been
25 herein described and illustrated in order to explain the nature
26 of the invention, may be made by those skilled in the art within

- 1 the principles and scope of the invention as expressed in the
- 2 appended claims.

1 Attorney Docket No. 79472

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A VEHICLE LAUNCH ASSEMBLY FOR UNDERWATER PLATFORMS

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ABSTRACT OF THE DISCLOSURE

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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.

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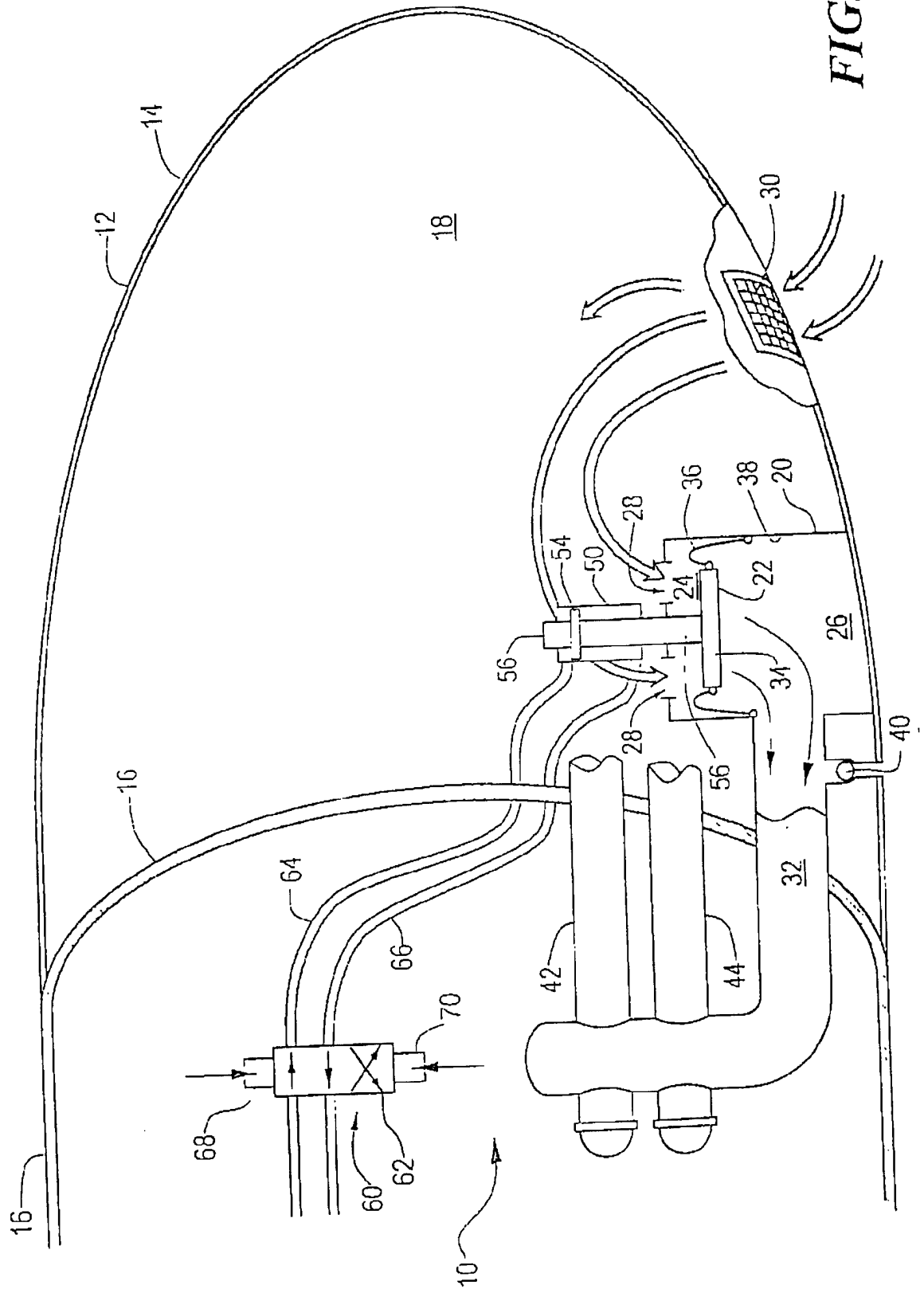


FIG. 1

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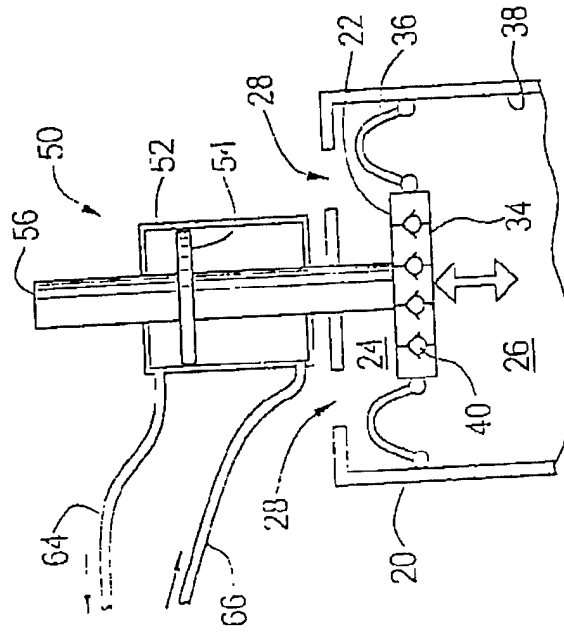


FIG. 6

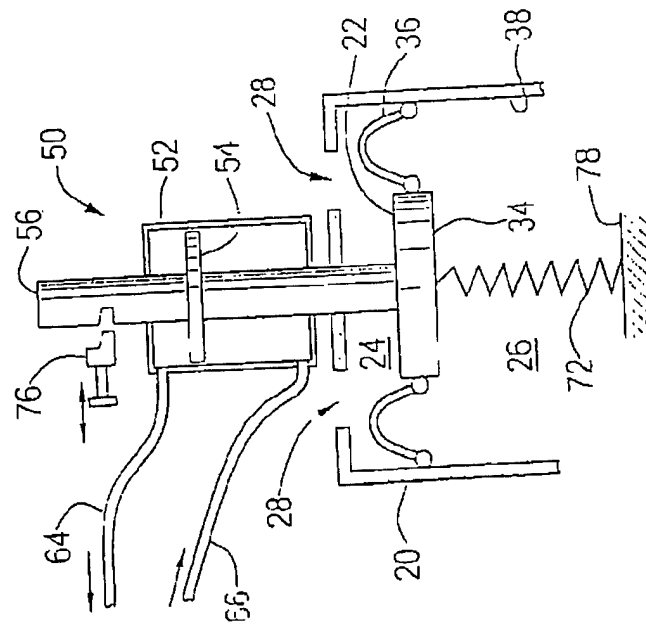


FIG. 5

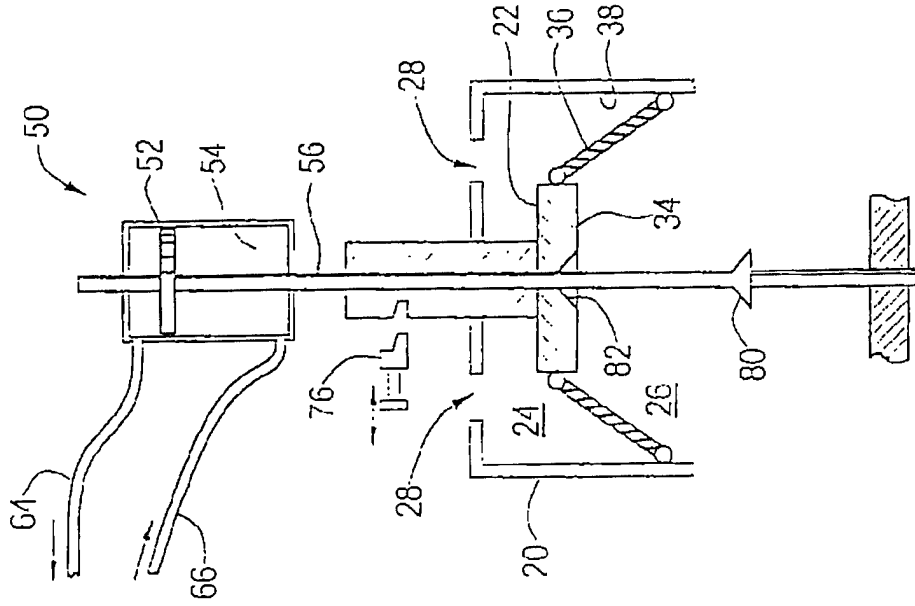


FIG. 7

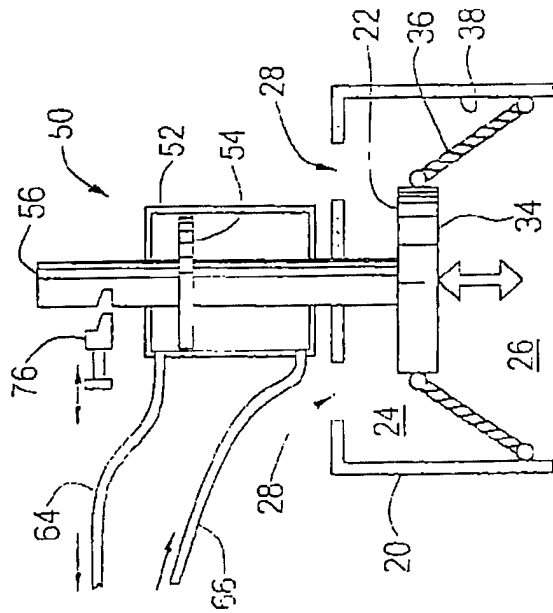


FIG. 8

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A VEHICLE LAUNCH ASSEMBLY FOR UNDERWATER PLATFORMS

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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