Aug. 13, 1963 T. K. MOY 3,100,421

POST-LAUNCH FLOODING CONTROL APPARATUS

Filed Jan. 8, 1962 2 Sheets-Sheet 1

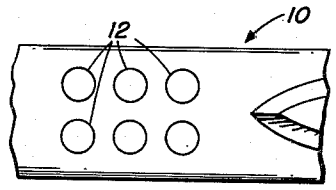


FIG. 1

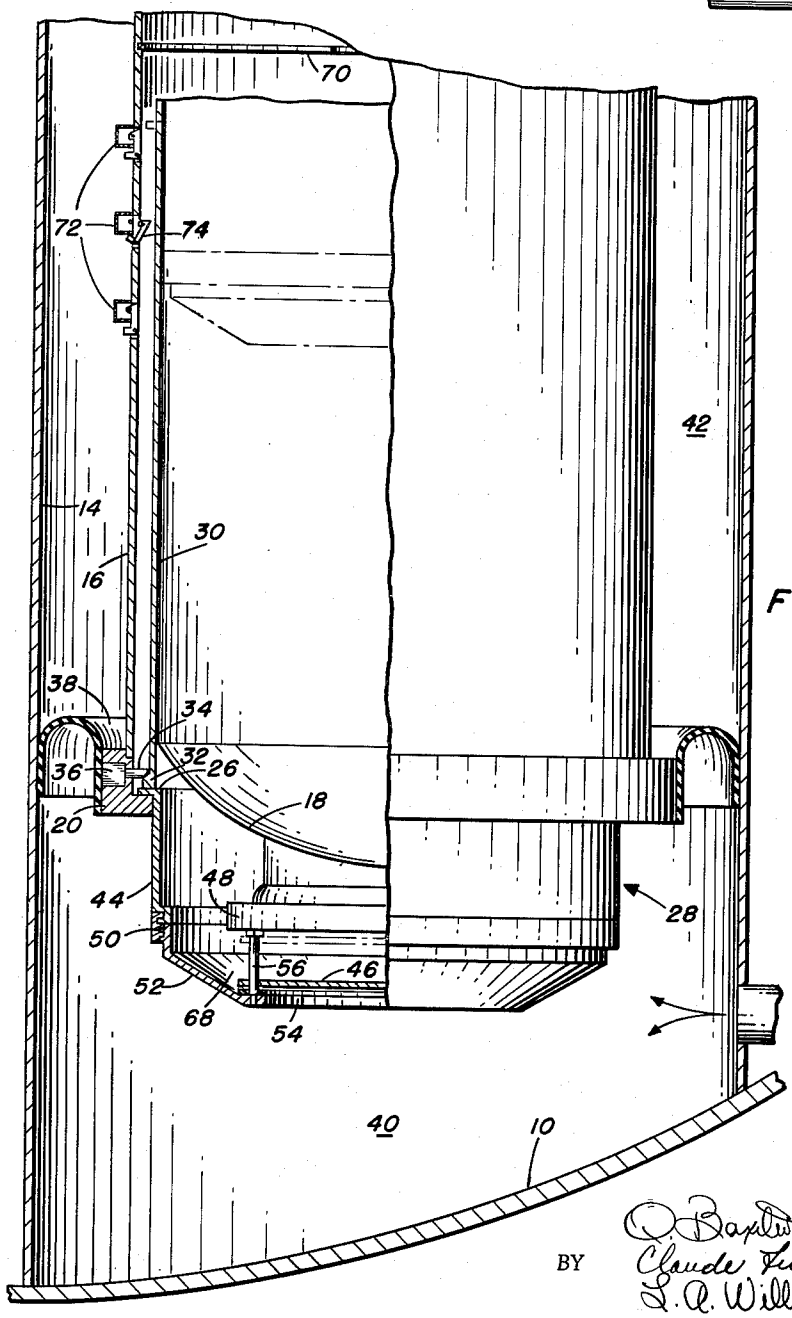


FIG. 2

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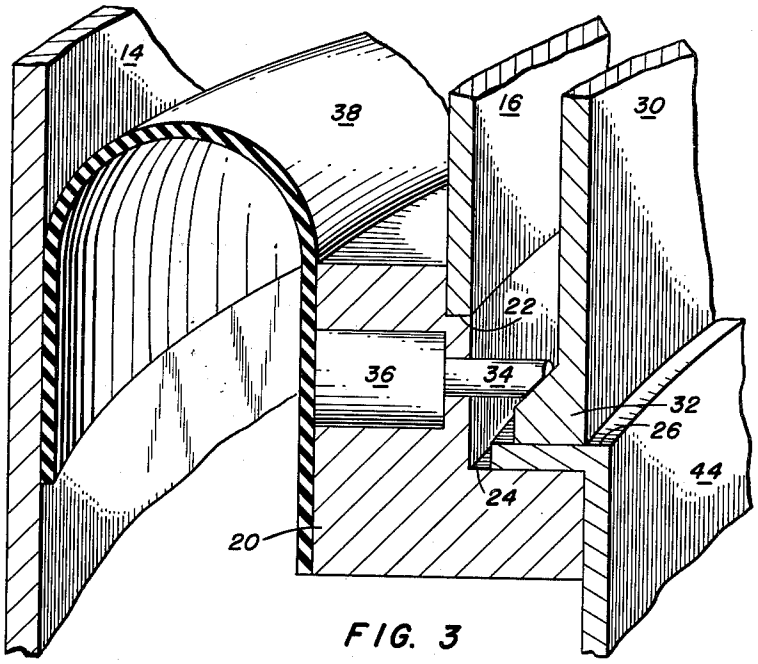


FIG. 3

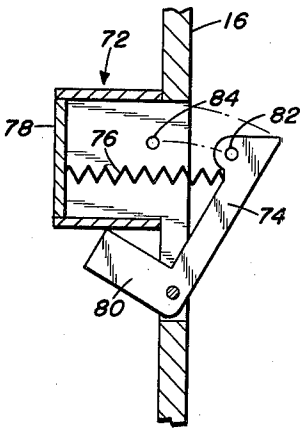


FIG. 4

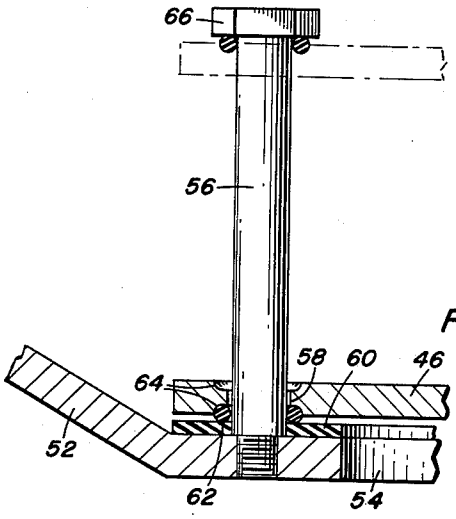


FIG. 5

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POST-LAUNCH FLOODING CONTROL APPARATUS

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2 Claims. (Cl. 89—1.7)

This invention relates generally to missile launching systems, and more particularly to an apparatus for controlling post-launch flooding occurring in submergible, vertically oriented missile launcher tubes.

During submerged launching of a missile using the tube launch technique, wherein a missile is launched from a vertically oriented tube mounted within a submergible ship hull, it is highly desirable that the total weight of the ship and its distribution before a missile has been launched remain the same after a launching has been executed in order to assure optimum ship maneuverability and stability. In practice, it is most often the case that the weight of the missile being ejected is considerably less than the weight of water flooding the launch tube subsequent to departure of the missile. A present practice consists of blowing out a prescribed amount of water from a compensation tank at a prescribed time and rate to compensate for the excess weight of water admitted into the launching tube after missile departure. If the excess water can be successfully prevented from ever entering the launcher tube, the present compensation tank requirement can be eliminated, resulting in considerable savings in cost and vital space.

Accordingly, one object of the present invention is to provide an apparatus for controlling the amount of post-launch tube flooding occurring in submerged, vertically oriented missile launching tubes.

Another object of the instant invention is to provide an improved missile launching tube having means operative to maintain the weight confined within such a tube before and after launching.

A further object of this invention is to provide an improved missile launching tube having a post-launch flooding control apparatus operative to maintain weight stability before and after launching regardless of the size of the missile being launched.

Still another object of the present invention is to provide a post-launch flooding control apparatus designed for easy incorporation into existing missile launching tubes.

Yet another object of this invention is to provide, in a ship having a plurality of submergible, vertically oriented launching tubes of symmetrical arrangement, a means operative to maintain the weight distribution of such ship after a launching has been executed equal to that existing before such launching, regardless of the weight of the particular missile launched and regardless of which tube the missile may be launched from.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a schematic plan view of a submarine hull showing a possible arrangement of vertical launching tubes arranged therewithin;

FIG. 2 is an elevational view, partially sectionalized, of the lower end of one of the launching tubes shown in FIG. 1, and shows the general arrangement of the post-launch flooding control apparatus with respect to the missile launching tube;

FIG. 3 is an enlarged view of a portion of FIG. 2 showing the mounting details of the post-launch flooding control device;

FIG. 4 is a detail view of the locking mechanism schematically indicated in FIG. 2; and

FIG. 5 is an enlarged view showing the details of the valve structure and mountings indicated generally in FIG. 2.

Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, and more particularly to FIG. 1, wherein there is shown a portion of a submergible ship hull **10** having arranged therein vertically extending launching tubes **12**. In observing FIG. 1, it will be appreciated that upon the occurrence of a change in the weight housed within a given tube, an imbalance will be created which will adversely affect ship maneuverability and stability. Such a change in weight will normally occur upon the launching of a missile from one of such tubes in that it is most often the case that the missile launched weighs considerably less than the water flooding such tube after the missile has departed. It is therefore clear that a device overcoming such weight variation without requiring additional space would be highly desirable. FIGS. 2 through 5 are illustrative of a preferred embodiment of such a device and attention is now directed thereto.

In that the details of each of the launching tubes schematically indicated in FIG. 1 are substantially identical, the following description will be limited to a single, typical tube. A sectionalized elevation view of the lower portion of such a tube is shown in FIG. 2 and includes an outer tube **14** surrounding a coaxially mounted inner tube **16**, which in turn houses missile **18**, indicated in dotted lines. The missile is supported vertically within inner tube **16** by means of an annularly shaped missile support ring **20** which is positioned at the lower end of the inner tube and affixed thereto by any desired means not a subject of the instant invention. The missile support ring **20** is provided with interior step flanges **22**, **24** which are formed to receive, respectively, the lower end of inner tube **16** and the flanged portion **26** of the valve assembly, generally indicated as **28**. Missile skirt **30** of missile **18** in turn rests upon flanged portion **26** and, at its lower extremity, is provided with an outwardly protruding rib or beaded portion **32** which cooperates with a plurality of latching shoes **34** to restrain the missile against upward movement until the desired ejection air pressure has been obtained. These latching shoes **34** may be actuated by solenoid devices schematically indicated at **36**. A flexible annular seal **38** extends between the lower portions of the inner and outer tubes **16**, **14**, respectively, to provide a fluid type partition between plenum chamber **40** and upper annular area **42**. It is desirable to point out at this juncture that the configuration, interrelationship, arrangement, and mode of operation of missile support ring **20**, the interconnection of the inner tube **16** with the missile support ring **20**, the seal **38**, the latching shoes **34** and their associated actuating devices **36**, and the configuration of missile skirt **30** comprise no essential part of the instant invention and will necessarily be varied to suit the requirements of a particular installation.

Attention is now directed to the details of the valve assembly **28**, as best shown in FIGS. 2, 3, and 5, wherein it can be seen that the valve assembly consists of essentially two components, a sabot **44** and a gravity check valve **46**, with its associated mounting structure. The sabot is a tubular member of a diameter somewhat less than that of the inner tube **16** and is provided with a relatively wide flanged portion **26** at its upper end which engages step flange **24** of the missile support ring **20** when the sabot is in its pre-launch position at the lower extremity of inner tube **16**. When check valve **46** is in its lowered, closed position, as indicated in solid

lines in FIGS. 2 and 5, the sabot **44** acts as a substantially fluid-impervious partition between plenum chamber **40** and the upper regions of the inner tube **16**. The sabot is sized to extend sufficiently below the missile support ring **20** in order to insure that the operation of check valve **46** will not interfere with exhaust nozzles **48** of missile **18**. The lower end of sabot **44** is provided with internal threading or a manually operated breech-type locking ring **50** to provide ready disengagement of check valve mounting cone **52** from sabot **44** for purposes of missile inspection. The mounting cone is provided with a centrally located aperture **54** of any desired configuration, a circular one being shown in the drawings. Around the periphery of this aperture, there is provided equi-spaced, vertically extending stud bolts **56** which may be secured in any suitable fashion. Check valve **46** is provided with matching bores **58** of slightly larger diameter than stud bolts **56**, thereby rendering the check valve free to reciprocate therealong in a fashion later to be described. In order to promote a fluid-type seal between check valve **46** and mounting cone **52**, the latter may be provided with rubber gasket **60** overlain by a rubber O-ring of somewhat less resiliency, which O-ring **62** registers with notched out portions **64** of the bores **58** formed in the check valve **46** when the latter is in its closed position. The upper ends of stud bolts **56** may likewise be provided with similar O-rings received in similar notches and restrained against upward movement by means of stop nuts **66**. In this position the O-rings primarily serve as buffers against the slamming action of check valve **46** when the latter is caused to move rapidly to its fully opened position, as indicated in dotted lines in FIG. 2.

It is now desired to describe an additional feature of the present invention which renders it possible for valve assembly **28** to compensate for varying missile weights. Preliminarily to this, however, the general scheme of operation of the overall structure should be related to in order that this variable missile weight feature may be more fully and easily understood.

Starting with a pre-launch condition, the valve assembly **28** will be in the position indicated by solid lines in FIG. 2, wherein flanged portion **26** rests upon step flange **24** of the missile support ring **20**, and missile **18** will be in the position indicated by dotted outline. The actual launching of missile **18** commences with the introduction of high pressure ejection air into plenum chamber **40**, which chamber constitutes an air tight space defined by the ship hull structure, the outer tube **14**, seal **38**, inner tube **16**, and valve assembly **28**. As ejection air pressure builds up within plenum chamber **40**, the weight of disc-shaped check valve **46** will be overcome causing it to rise along stud bolts **56** to a substantially fully open position against stop nuts **66**, as indicated in dotted lines in FIG. 2, thereby communicating area **68** with plenum chamber **40** and resulting in a rapid build-up of pressure within area **68**, thereby initiating a rapid upward travel of missile **18**. However, because of the throttling effect of check valve **46**, the pressure in plenum chamber **40** will exceed that within area **68** substantially during the entire time that any portion of missile **18** remains within the launching tube **16**. This pressure variation acts upwardly on the undersurface of valve assembly **28** to urge the same upward against missile skirt **30** as the latter is urged upwardly by virtue of the pressure within area **68**. It will therefore be appreciated that valve assembly **28**, by virtue of the piston ring-like action of flange portion **26** along the inner surface of launching tube **16**, serves a secondary purpose in functioning as a piston to urge the missile **18** upwardly and out of the launching tube. When the valve assembly has reached a predetermined upper point of travel within launching tube **16**, it is restrained against further upward travel by means of any suitable stop means provided along the inner surface of launching tube **16**. As shown in FIG. 4, this stop means may take the form of a conventional split ring **70** mounted within an interior groove in tube **16** and extending inwardly therefrom to a point sufficient to assure engagement with the valve assembly flange portion **26**, yet to present no obstruction to free passage of missile **18**. After being arrested by the stop means and upon decay of ejection air pressure, the valve assembly **28** will tend to descend to its original, pre-launch position. At approximately the same moment, post-launch flooding will commence by way of the momentarily opened upper end of the launching tube **16**. Prior to the admission of any significant amount of post-launch flood waters, however, the valve assembly **28** will have descended to a point of engagement with a pre-selected group of locking means now to be described.

As shown in FIG. 2, these locking means are arranged in a plurality of circumferentially extending belts about the launching tube **16**, three separate belts being shown in FIG. 2. Depending on the weight of the missile to be launched, the proper belt of locking mechanisms **72** is brought into play to engage the valve assembly **28** at a desired level within launching tube **16**. For example, should a relatively light missile be discharged from launch tube **16**, it is clear that only a relatively small portion of water can be admitted to the launch tube if ship stability and maneuverability are to be maintained. Therefore, the upper belt of locking mechanisms will be placed in their operative position to engage the valve assembly **28** at a position higher within the tube than would be the case with a heavier missile. Similarly, on firing one of the heavier missiles, the lower belt of locking mechanisms will be placed in operative position and the belts upstream thereof will be rendered inoperative to allow passage of the valve assembly to the lower level where it will be locked against further downward travel and where the impending post-launch flood waters will effect movement of check valve **46** to its lower closed position, thereby sealing off the lower region of tube **16**.

Any of several conventional one-way locking mechanisms widely available may be employed in the multi-level belt arrangement indicated in FIG. 2 and only one possible embodiment will now be described. Referring to FIG. 4, such a locking mechanism may comprise a spring biased detent **74** pivotally mounted in the wall of tube **16** and urged to an operative position, as indicated in dotted lines in FIG. 4, by means of spring **76**, which spring seats against and is housed within spring cover **78**. The extent to which detent **74** is allowed to project into the interior of tube **16** when in its operative position is controlled by means of an integral lug **80** which is operative to abut spring cover **78** when detent **74** is allowed to assume its extended, operative position. When in its inoperative position, detent **74** lies flush with the inner surface of tube **16**, thereby presenting no obstruction to the downward travel of the valve assembly **28**. An integral eyelet **82** is formed on the outer end of detent **74**, which eyelet registers with a similar wall-mounted eyelet **84** when the detent is urged to its inoperative, flush position, as indicated in solid lines in FIG. 4, whereby a locking pin or other suitable means, not illustrated, may be inserted therethrough to retain the detent in its retracted, inoperative position. This locking mechanism is only one of many similar one-way locking devices that may be employed, the only requirements being that the device employed be capable of being locked out in an inoperative position and also of the type that will allow free passage of an object in one direction, yet prevent return passage of such object.

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

What is claimed is:

1. A submergible missile launching system comprising in combination

a vertically oriented missile launching tube, and

a post launch flooding control valve assembly comprising annular abutment means secured in said tube adjacent the top thereof and disposed in the path of travel of said valve assembly,

partitioning means slidably mounted in said tube and normally reciprocable between the bottom of said tube and said abutment means, said partitioning means having a fluid inlet opening therein, a fluid actuated check valve normally sealing said opening slidably mounted within said partitioning means for controlling the flow of fluid through the opening according to the position of the partitioning means in the tube and the position of the check valve in the partitioning means, a plurality of stud bolts carried by and disposed within the partitioning means for slidably mounting the check valve, sealing means carried by said bolts, seat means carried by the check valve and cooperating with said sealing means on the bolts for providing a fluid tight connection therebetween, stop devices carried by said stud bolts at one end thereof and normally spaced from the check valve for controlling the movement of the check valve as said opening is unsealed,

a plurality of circumferentially and longitudinally spaced one-way locking devices carried by said tube to permit upward movement of said partitioning means as a missile is being launched and selectively operable between effective and ineffective conditions wherein downward return movement of said partitioning means is prevented and permitted respectively whereby the amount of inundation of said tube by ambient water after missile launching may be controlled, and annular flange means on the partitioning means engageable with said abutment means for limiting the upward movement of the partitioning means.

2. The apparatus according to claim 1 wherein each locking device of said plurality of locking devices comprises a spring-biased detent pivotally mounted in the wall of said tube and normally locked thereto so as to be flush with said wall when in said ineffective condition, spring means engaging the detents and the tube for extending the detents into the path of travel of said partitioning means to said effective condition thereby securing said partitioning means against downward movement in said latter condition, stop means on the detents engageable with the tube for limiting the movement of the detents to the effective condition; and

keeper means carried by said wall in locking engagement with said detents for releasably retaining said detents flush with the wall in said ineffective condition.

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