MISSILE CONTAINER SUSPENSION SYSTEM

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FIG. 7
This invention relates to containers and more particularly to a missile package consisting of a suspension system and an outer container capsule. The combining of these two components afford shock and environmental protection to a missile during handling, transportation and field and shipboard stowage phases.

The missile package consists primarily of an outer container or capsule and an inner tube or shell capable of withstanding launching pressure and also heat encountered during hot launching. The inner tube is composed of a non-reactive aluminum alloy and surrounds the missile and is maintained out of direct contact with the missile by suitable guides and seal. The missile-base end of the inner tube is closed and provided with a centrally disposed swivel-gland aperture in which is disposed a swivel gland, the nose end of the inner tube being provided with a removable cover. The segment or portion of the tube which encloses the missile re-entry body is also removable, thereby to allow the re-entry body to be mated to the missile in the tube in the event it should be necessary to store re-entry body separately. A plurality of pad-type transversely disposed air springs are attached to the outer surface of the inner liner and are provided with nylon sheeting on the outer surface thereof to prevent scuffing and to permit sliding of the inner liner into the outer container or the submarine launching tube, as the case may be. A toroidal axial air spring is disposed between each end of the inner liner and the end caps or covers of the outer container and secured thereto in any conventional manner. The capsule or outer container provides environmental conditioning and adds physical protection to the missile disposed in the inner container during transportation and storage. It is hermetically sealed to maintain pressure and humidity and structurally designed to withstand handling and transportation loadings. The inner container supporting the missile may contain access ports and provisions for system checkout of the missile through umbilical plugs and for control of the internal pressure and atmosphere.

An object of the present invention is to provide a new and improved transportation and storage container for heavy objects.

Another object of the invention is to provide a new and improved container capable of protecting a delicate object container therein from severe shock and vibrations during handling, transportation and field and shipboard stowage phases.

Another object of the invention is to provide a missile package wherein the missile is always protected by a suspension system up to the time of firing and is never handled in its bare condition.

Still another object of the invention is to provide a missile package consisting of an outer capsule and an inner shell containing the missile and a suspension system between the outer container and the inner shell.

A further object of the invention is to provide a missile package wherein the inner missile container of the package may be readily transferred into the launching tube of a submarine.

A still further object of the invention is to provide a missile package wherein internal pressure of the missile contained therein may be maintained through permanent connections during handling, transportation, storage and shipboard stowage.

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 side elevational view of the missile container constructed in accordance with the present invention;

FIGS. 2 and 2A are enlarged longitudinal sectional views taken substantially on the line 2—2 of FIG. 1;

FIG. 3 is an enlarged transverse sectional view taken substantially on the line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary sectional view of one of the air spring arrangements;

FIG. 5 is a schematic view illustrating the container in a position so that the inner container and missile may be lowered into the launching tube of the submarine;

FIG. 6 is a view similar to FIG. 5 illustrating the inner container and missile being lowered into the launching tube, portions of the launching tube and outer container being broken away and in section;

FIG. 7 is a view partially in elevation and partially in section illustrating the inner missile container in firing position within the conventional submarine launching tube;

FIG. 8 is an enlarged sectional view illustrating the mating of the eject-air tube and the end cover of the missile containers; and

FIG. 9 is an enlarged fragmented sectional view illustrating the missile support ring, seals and hold-down devices.

Referring now to the drawings and more particularly to FIGS. 1, 2 and 2A thereof, the missile container suspension device, constructed in accordance with the present invention, is indicated generally by the numeral 10. The device 10 comprises an elongated outer capsule or container 11 having a forward section 12 and an aft section 13, the forward section being detachably secured to the aft section by mating flanges and bolts 15, or the like. The section 12 is provided with a cap or cover 16 detachably secured thereto by bolts 17, the cap 16 being provided with a centrally disposed access port 18 sealed by a disc or cover 19. The section 13 is provided with a similar cap or cover 21 detachably secured thereto by bolts 22, and having a centrally disposed access port 23 sealed by a disc or plate 24. The sections 12 and 13 are provided with a plurality of mutually spaced reinforcing bands or annuluses 25 which are of any desired configuration such, for example, as channel shape. The sections 12 and 13 are further provided with longitudinally extending reinforcing elements 26 and a pair of oppositely disposed pivotally mounted clevis devices or eyes 30 mounted on the section 12 near the cover 16, as best shown on FIGS. 1 and 5, to facilitate handling of the missile package.

An inner liner or shell generally indicated by the numeral 27 is disposed within the outer container or capsule 11 and comprises a forward tubular section 28 and after tubular section 29, the forward section 28 being detachably secured to the after section 29 by flanges 31 and bolts 32. The section 28 is closed and sealed by a cover 33, the cover being detachably secured thereto, as by bolts 34 and provided with a centrally disposed eye 35 to facilitate handling of the inner container 27. The after section 29 is closed by a cover 36 detachably secured thereto, as by bolts 37, the cover having a flanged portion 38 integrally formed therewith and forming a centrally disposed opening 39 in the cover normally sealed by a plate 39A. A support, FIGS. 7 and 8, generally indicated by the numeral 41 is attached to the cover 36.
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3. After the plate 39A has been removed therefrom and prior to installation of the inner container into a launching tube and includes a downwardly and inwardly flared portion 42 terminating in a flange 44 which is secured to the cover 36 in any suitable manner such, for example, as by bolts or the like 45. Rotatably mounted by reason of the aforesaid flared portion 42 and flanges 38 is a member 49 having an O ring 48′ carried thereby midway between the terminal ends thereof as best shown on FIG. 8, the purpose of which will be hereinafter more fully described.

As more clearly shown on FIGS. 2A and 9 a sealing and hold-down arrangement 46 is carried by and disposed with the after end of the inner container. The aforesaid structure is provided with an annular member 47 attached to the inner container in any conventional manner the member 47 carrying sealing gaskets or rings 48 and 49 in sealing engagement with the tail end of the missile, as best shown in FIG. 2A and 9. A plurality of hold-down elements 49A, are carried by the member 47 and are provided with pressure operated detents or hold-down devices 49B normally disposed within an annular groove G found in the tail end of the missile M, whereupon the missile M is normally locked to the inner container 27. The section 29 of the inner container has disposed therein a plurality of mutually spaced guide orifices 50 composed of any material suitable for the purpose such, for example, as rubber or the like. By this arrangement together with the structure 46 direct contact of the missile with the inner container is prevented and a sealed chamber 51 is provided at the tail end of the missile.

The sections 12 and 13 of the capsule 11 are provided with normally sealed access ports 77, as best shown in FIG. 1, which provide for system checkout of the missile through the umbilical plug 64 and for control of the internal pressure and temperature. Access is also readily available through sealable ports 78 in the inner container 27 which match the access ports 77 of the outer container or capsule 11. It will be further understood that the section 12 of the capsule 11 is removable and the section 28 of the inner container 27 is also removable. This feature allows the re-entry body R of the missile to be mated to the missile M in the inner container if it should be necessary to store the re-entry body separately.

It will be noted on FIGS. 2, 2A and 4 that a plurality of pad-type air springs 53 and 54 are circumferentially disposed about the section 29 of the inner container, the air spring having the inner surface thereof attached to the section 29 and the outer surface thereof provided with a sheathing 55, composed of any synthetic material such, for example, as nylon, whereby the inner liner may readily slide in the outer container or the submarine launching tube, as the case may be. It will be understood that the air springs 53 and 54 are normally charged and disposed between the outer surface of section 29 of the inner container and the inner surface of section 13 of the outer container. Each of the aforesaid air springs 53 and 54 are provided with a surge tank 56 carried by the section 29 of the inner container and connected in fluid communication with their respective air spring by a pipe or conduit 57.

The cap 16 carries a toroidal air spring 58 connected to a surge tank 59, as by a pipe or conduit 61. A similar toroidal air spring 62 is carried by the cap 21 and connected to a surge tank 63, as by a pipe or conduit similar to the pipe 61. By the aforesaid air spring arrangement the missile is protected against vibration and shock loads encountered during shipping, handling and shipboard storage, it being understood that the pad-type air springs provide transverse support to the inner liner and the toroidal air spring at each end of the container provides axial support thereof.

The inner container or shell may be provided with conventional umbilical plug 64 to provide for system checkout and for control of the internal pressure and temperature, umbilical and servicing connections being made in the submarine through the launching tube in the conventional manner.

The docking operation of transferring the missile from the cover 36 to the storage or launching tube of the submarine is shown on FIGS. 5 through 7. A sling 65, FIG. 5, is attached from a suitable hoist (not shown) to the eyes 59 carried by the outer container 11 and the con-

The cover 11 is then uninned and hoisted to a position over the submarine storage or launching tube T. However, prior to attaching the sling 65 to the container and hoisting the cover 11 into the position as shown in FIG. 5, the forward inspection cover 19 is removed from cap 16 and is in place thereof a conventional winch 66 is attached thereto. Thereafter the section 12 is detached from section 13 of the capsule 11 and a cable 67 carried by winch 66 is attached to eye 35 on closure 33, it being understood that after the cable 67 has been attached in the aforesaid manner, the section 12 is attached to the section 13 of the capsule and the end cap 21 is removed from section 12. When this has been done the capsule is hoisted and moved to the position shown on FIG. 5 in the aforesaid manner. It will be noted, FIG. 5, that a detachable guard rail 63 is employed to protect and guide the capsule as the capsule is moved into the position with the storage or launching tube T and that a plurality of guy wires 69 support the capsule in this position.

It will be noted in FIG. 6 that when the package 10 in a missile transfer position, the after end of the cap-

sule or outer container 11 is seated on the upper end of the tube T and thus the outer and inner missile containers are in axial alignment with the tube T and thus the inner missile container may be lowered into the tube T. During the lowering operation, if desired, the transverse air springs 53 and 54, may be partially deflated so that the inner missile container may readily be lowered down through the outer container and into the tube T by the winch 66 and cable 67, as the winch is operated, as best shown in FIG. 6. It will be understood that during the aforesaid lowering operation of the toroidal air spring 58 carried by cap 16 remains with the capsule.

With reference to FIG. 7, it will be noted that as the missile container reaches the bottom of the tube T, conventional eject-air tube 71 automatically enters the swivel gland 41 carried by end closure plate 36, and is sealed thereto by the O ring 40′. In this position the cover or closure 11 is attached to the inner container 27. The section 28 of the lower end of the tube T and controlled by a surge tank 73 connected thereto in a manner similar to the connection between air springs 53, 54, 58 and 62. By the aforesaid arrangement the missile container 27 is provided with transverse protection by the air springs 53 and 54 and axial protection by the toroidal air springs 62 and 68.

When the inner liner or missile container has been lowered into tube T in the aforesaid manner the capsule 11 is removed from the launching tube by the sling 65 and hoist (not shown) the cover 33 is detached from section 28 of the inner liner 27 and is replaced with a sealing diaphragm 74 disposed between the tube T and the section 28 and a large frangible diaphragm 75 disposed at the upper terminal end of the section 28 in sealing engagement therewith, as best shown in FIG. 7. After the diaphragms 74 and 75 have been attached to the tube end section, the conventional launcher tube cover 76 having suitable sealing means is moved into engagement with the tube T thereby further sealing the section 28 and the aforesaid inner container 27. During a launching operation the cover 76 is moved to unseal the tube T and missile container 27.

When the inner container has been installed into the tube T the aforesaid hold-down detents 49B releasably hold the missile until the missile is fired and suitable
latches 49C or the like, carried by tube T, hold the inner container in place as the missile is fired.

From the foregoing it will be apparent that the missile package consists of an inner missile container, an outer container anddisposed within said container, means for releasably locking the missile to the inner container, spring means in engagement with each pressure operated detent of said plurality of detents for maintaining the detents in the groove until the detents are operated, means for establishing a pressure connection to each pressure operated detent, normally sealed access ports disposed at opposite ends of the capsule, pad type air springs including surge tanks disposed within the capsule between the capsule and inner container for providing transverse support for the inner container, and toroidal air springs including surge tanks disposed within the capsule between the terminal ends of the capsule and terminal ends of the inner container for providing axial support for the inner container.

1. A shock absorbing package for delicate objects comprising a normally sealed container, a normally sealed inner container disposed within the outer container in spaced relation with respect thereto, a missile disposed and sealed within said inner container and releasably locked thereto, said missile having one end of the missile pressure actuated detent means normally disposed within said groove for releasably locking the missile to the inner container, spring means in engagement with the pressure actuated means for maintaining the detent means in the groove until the pressure actuated detent means are operated, release position means for establishing an external pressure connection with the pressure actuated detent means, a first group of mutually spaced pad type air springs carried by and circumferentially disposed about the inner container in engagement with the outer container, a first group of surge tanks connected individually to said first group of pad type air springs, a second group of surge tanks connected individually to said second group of pad type air springs, a first toroidal air spring carried at one end of the outer container in engagement with one end of the inner container and having surge tank connected thereto, and a second toroidal air spring carried at the other end of the outer container in engagement with the other end of the inner container.

2. A shock absorbing package for a missile comprising a normally sealed capsule, a normally sealed inner container disposed within said capsule in spaced relation with respect to said capsule and having a missile support ed therein and releasably locked thereto, means including sealing elements disposed within the capsule for supporting the missile in spaced relation with respect thereto, an annular groove formed in the missile, a plurality of pressure operated detents carried on the inner container and disposed within said container, means for releasably locking the missile to the inner container, spring means in engagement with each pressure operated detent of said plurality of detents for maintaining the detents in the groove until the detents are operated, means for establishing a pressure connection to each pressure operated detent, normally sealed access ports disposed at opposite ends of the capsule, pad type air springs including surge tanks disposed within the capsule between the capsule and inner container for providing transverse support for the inner container, and toroidal air springs including surge tanks disposed within the capsule between the terminal ends of the capsule and terminal ends of the inner container for providing axial support for the inner container.

3. A shock absorbing missile package comprising a normally sealed capsule, a normally sealed inner container disposed within said capsule in spaced relation with respect to said capsule and having a missile supported therein, pad type air springs including surge tanks carried by said capsule and disposed between the capsule and the inner container for providing transverse support for the inner container, toroidal air springs including surge tanks carried by said capsule and disposed within the capsule between the terminal ends of the capsule and inner container for providing axial support for the inner container, means carried by and disposed within the inner container in sealing engagement therewith and with the missile for providing a sealing connection therebetween, hold-down means carried by the inner container in engagement with the missile for releasably maintaining the missile within the inner container, said hold-down means including pressure operated means carried by the inner container and normally in locking engagement with said missile, spring means in engagement with said pressure operated means for maintaining the pressure operated means in locking engagement with the missile until the pressure operated means are actuated to a release position by the pressure, and means for establishing an external pressure connection to the pressure operated means.

4. A shock absorbing missile package according to claim 3 wherein said sealing means includes an annular member carried by the inner container at the lower end thereof and a pair of sealing elements carried by the annular member in sealing engagement with the missile.

5. In combination with a missile launching tube, a container disposed within said launching tube in spaced relation with respect thereto, a missile disposed within said container, a plurality of shock absorbing pad type air springs carried by and circumferentially disposed about said container in engagement with said tube, a plurality of surge tanks carried by the container and connected to one of each of said plurality of pad type air springs, a shock absorbing toroidal air spring carried by the tube in engagement with said container at one end thereof, means carried by the container for sealing the container at the other end thereof, hold-down means carried by the tube in engagement with the container, additional hold-down means carried by the container, said additional hold-down means including pressure operated means normally in locking engagement with the missile, spring means for maintaining the pressure operated means in locking engagement with the missile until the pressure operated means are actuated to a release position as pressure is applied thereto, and means for establishing an external pressure connection to the pressure operated means.

6. In combination with a missile launching tube, a container disposed within said launching tube and having a closure plate at one end of the container and a frangible diaphragm at the other end thereof, a missile disposed
within said container and releasably locked thereto, sealing means carried by said container in engagement with said missile and the container and forming a pressure chamber between said closure plate and the sealing means, an ejector-air tube disposed within the launching tube and extending into said pressure chamber, a swivel gland rotatably mounted on said closure plate for receiving said ejector-air tube, a sealing gasket carried by said swivel gland in sealing engagement with the ejector-air tube for providing a sealing connection therebetween and the pressure chamber means including a plurality of air springs for yieldably supporting the missile within the launching tube, fluid pressure actuated detents carried by the container in locking engagement with the missile for releasably locking the missile to the container and for releasing the missile as fluid pressure is applied thereto, resilient means for maintaining the detents in locking engagement with the missile, and means for establishing an external fluid pressure connection to the pressure actuated detents.

7. In combination with a missile launching tube, a container disposed within said launching tube and having a closure plate at one end and sealing diaphragms at the other end thereof, a missile disposed within said container, sealing gaskets carried by said container in sealing engagement with said missile and forming a pressure chamber between said closure plate and the sealing means, an ejector-air device disposed within the launching tube and extending into said pressure chamber, a swivel gland carried by said closure plate for receiving said ejector-air tube, a plurality of mutually spaced pad type air spring shock absorbers disposed between said container and the tube, a toroidal shock absorber supported within the tube in engagement with said closure plate, hold-down means carried by the tube in engagement with the container, a plurality of casings carried by said container, a pressure operated detent disposed in each casing of said plurality of casings, a spring disposed within each casing in engagement with the detent therein for normally maintaining the detent in locking engagement with the missile, and means in communication with each casing for establishing an external pressure connection thereto.

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