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McLaughlin et al.

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[54] **LIQUID BULK CARRYING SHIP**

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[51] **Int. Cl.**..... **B63b 25/08**

[58] **Field of Search**..... 114/68, 69, 72, 74 R; 220/63 R, 9 A, 63 A, 85 B; 244/135 B; 293/71 R, 71 P, DIG. 2; 161/203; 117/74, 77, 69

[56] **References Cited**

UNITED STATES PATENTS

326,896	9/1885	Bridge	114/69
995,557	6/1911	Peebles	114/77 R
2,314,555	3/1943	Preuss	114/74 R
2,421,613	6/1947	Gray et al.	220/63 A
2,774,704	12/1956	Smith	220/63 R
3,024,941	3/1962	Vandenberg	220/63 R
3,307,512	3/1967	Fell	114/74 R
3,475,383	10/1969	Stewart	220/63 A
3,588,159	6/1971	Duckett et al.	293/71 R
3,622,035	11/1971	Suter	220/63 A
3,632,791	1/1972	Rupprecht et al.	161/203

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[57] **ABSTRACT**

A liquid carrying tanker comprising a plurality of closed individual reservoirs for receiving a liquid, an ejecting piping system for connecting the upper part of each reservoir to an empty space, and an impermeable, elastomeric tailored lining releasably fixed to the inner walls of said reservoirs, the said lining being adapted to separate from the walls of at least one of the reservoirs upon a predetermined minimum external concussive pressure and deformation of the walls of said one reservoir, the lining being adapted to stretch upon said pressure and deformation and force the liquid contained therein to flow through said ejecting piping system and towards said empty space.

8 Claims, 20 Drawing Figures

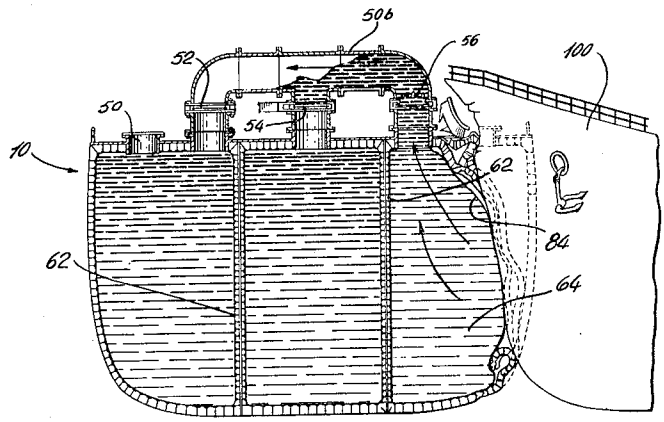
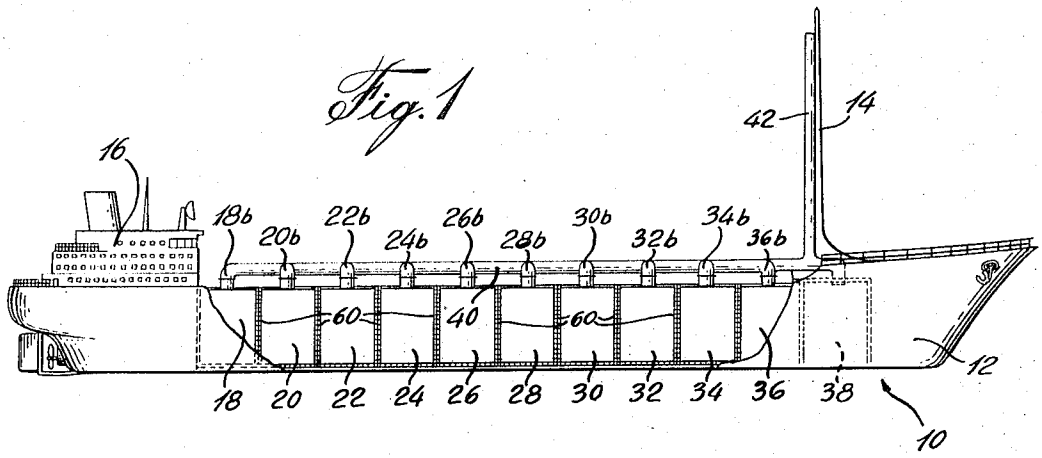


Fig. 1



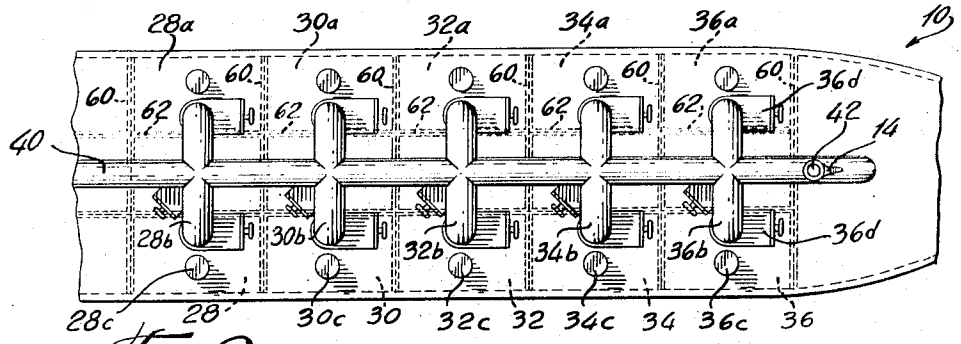


Fig. 2

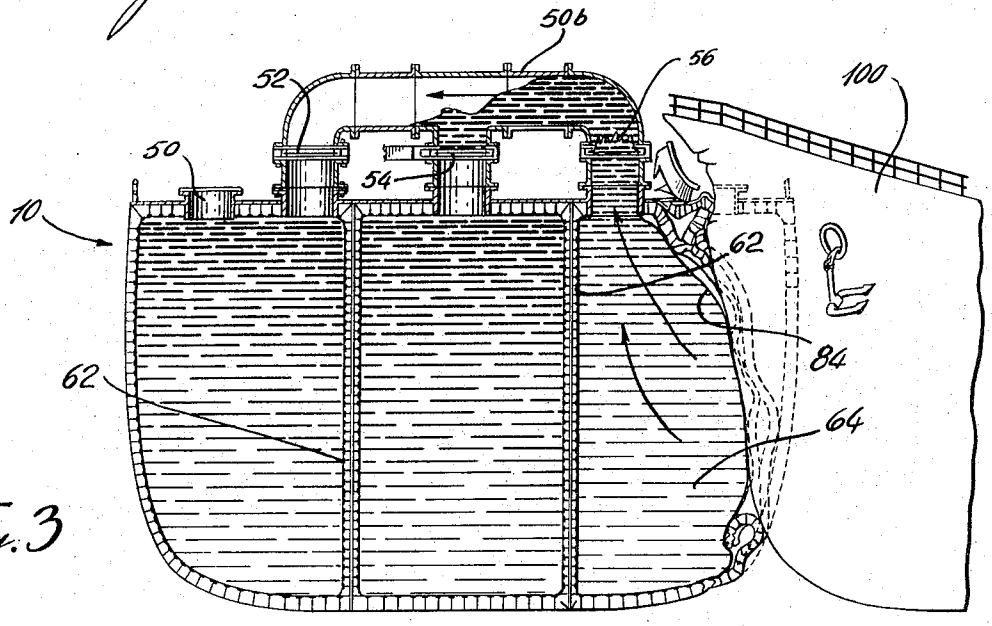


Fig. 3

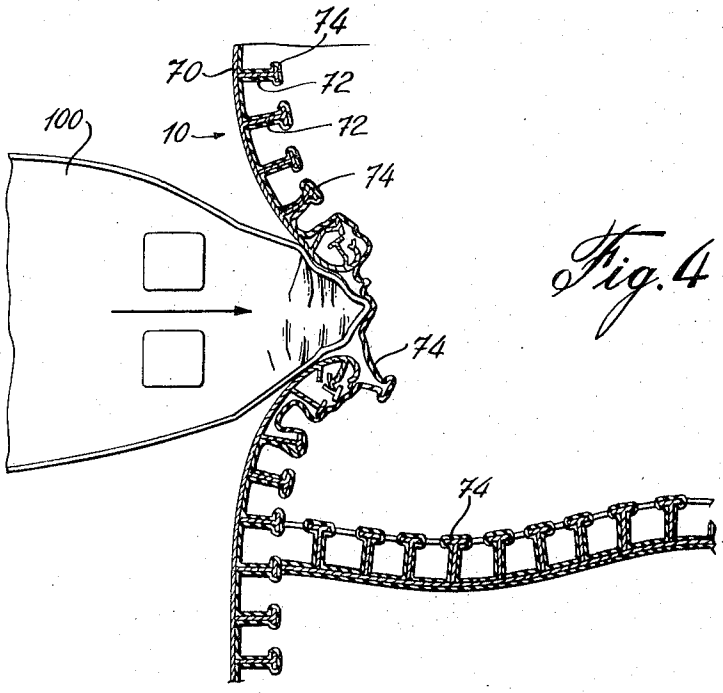


Fig. 4

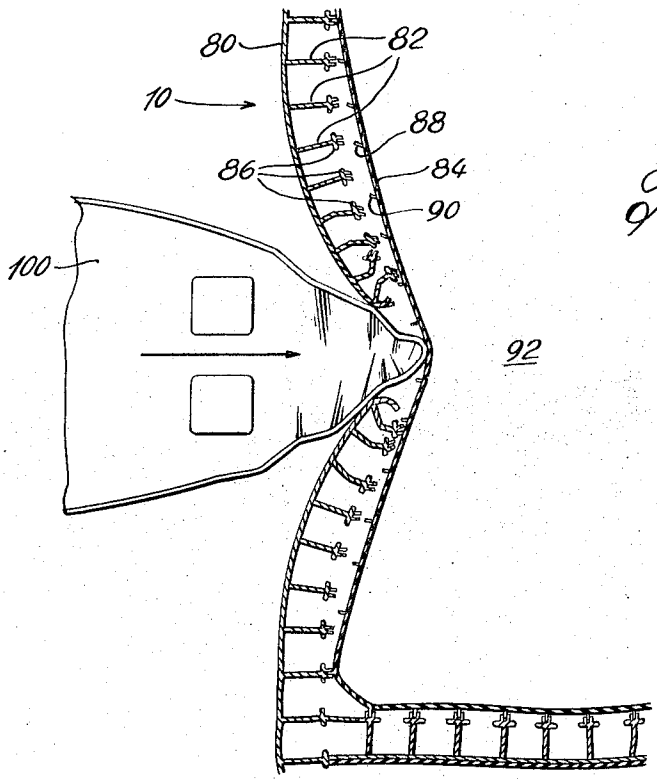


Fig. 5

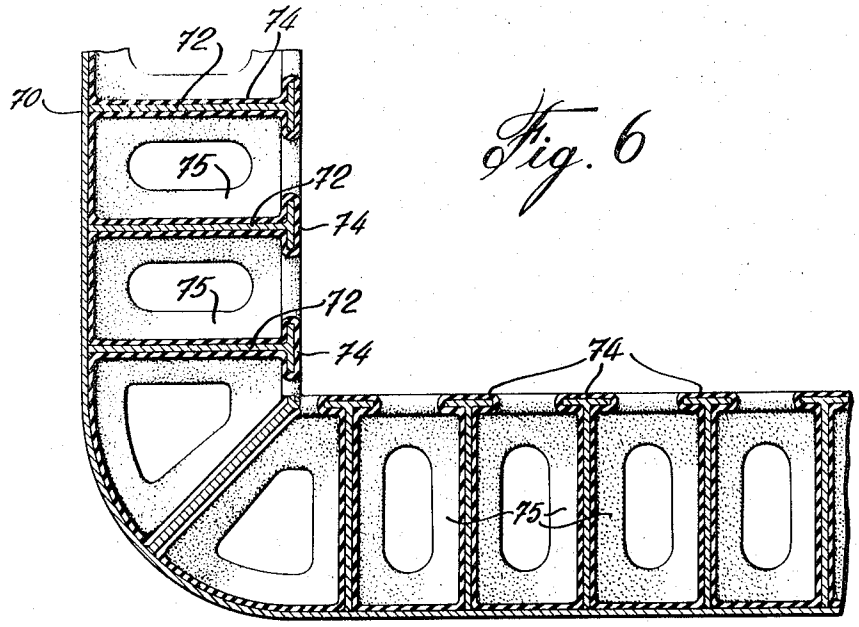


Fig. 6

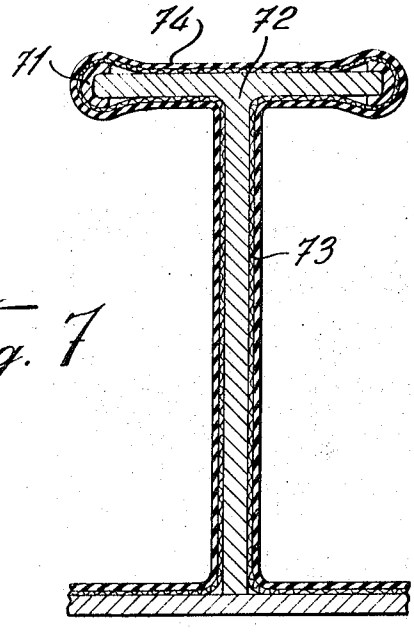


Fig. 7

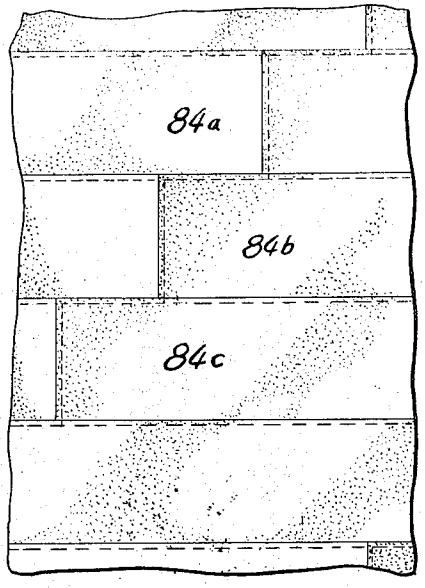


Fig. 20

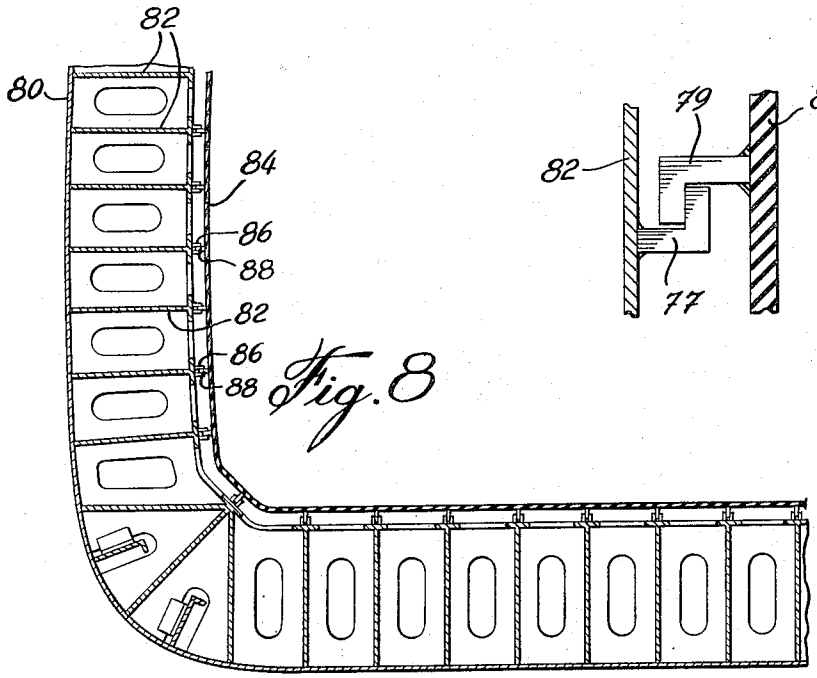


Fig. 8

Fig. 9

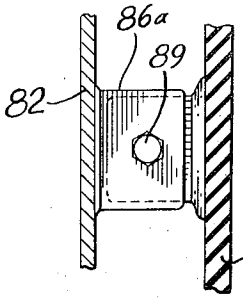


Fig. 10

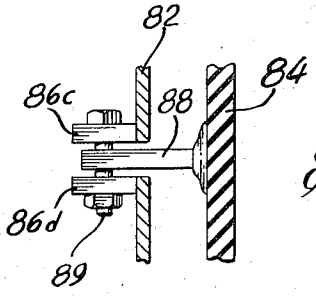


Fig. 12

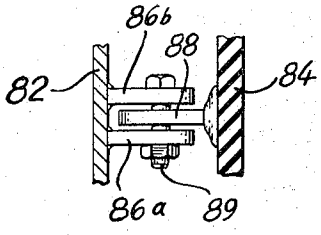


Fig. 11

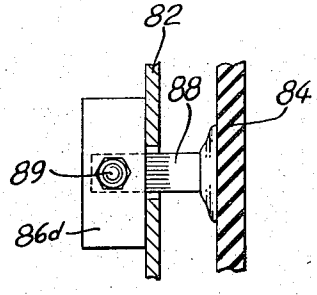


Fig. 13

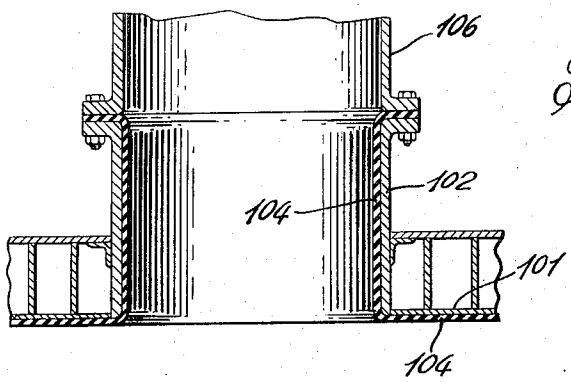


Fig. 14

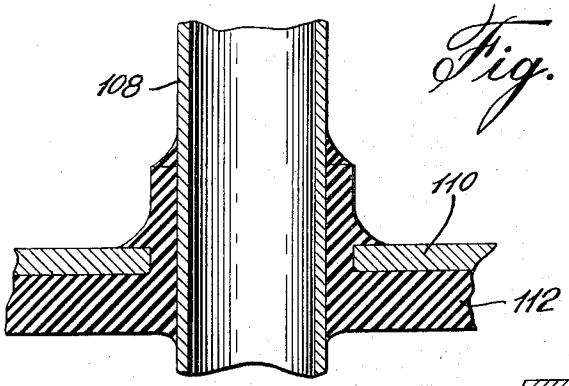


Fig. 15

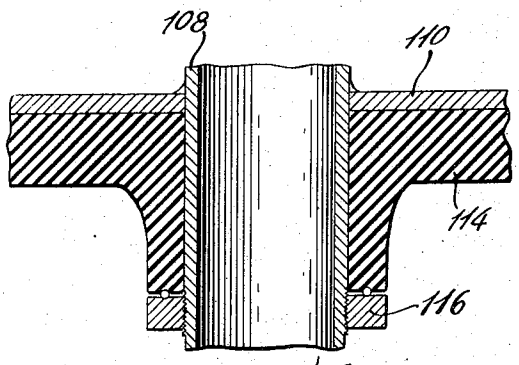


Fig. 16

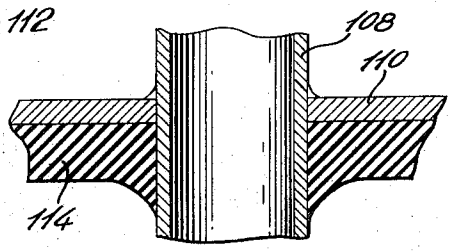
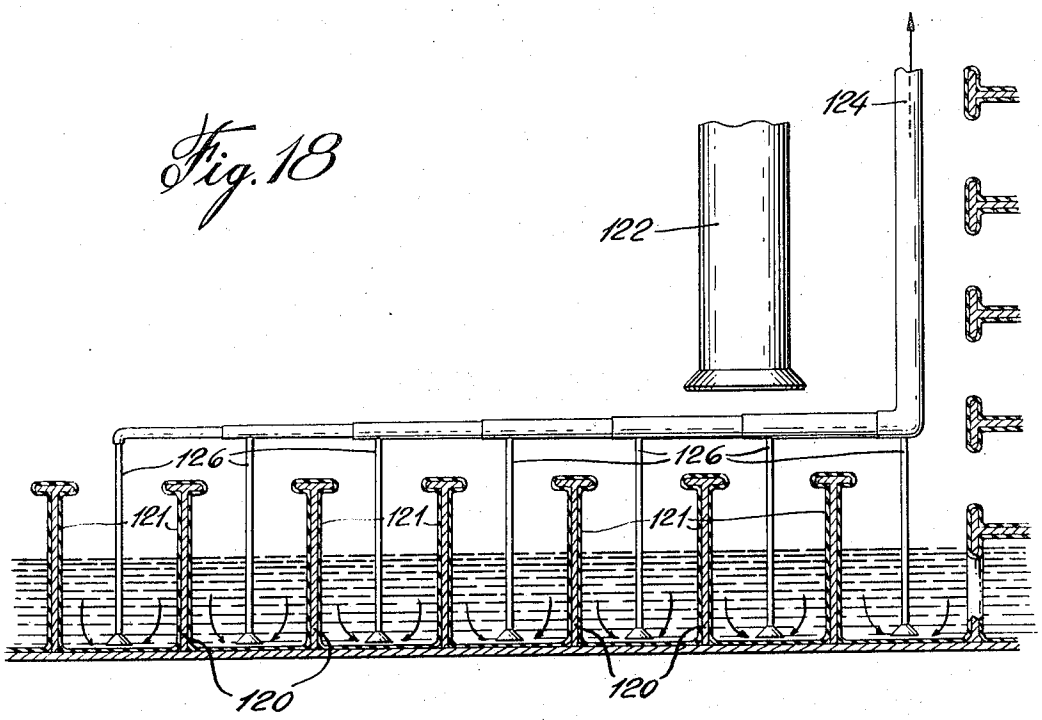


Fig. 17

Fig. 18



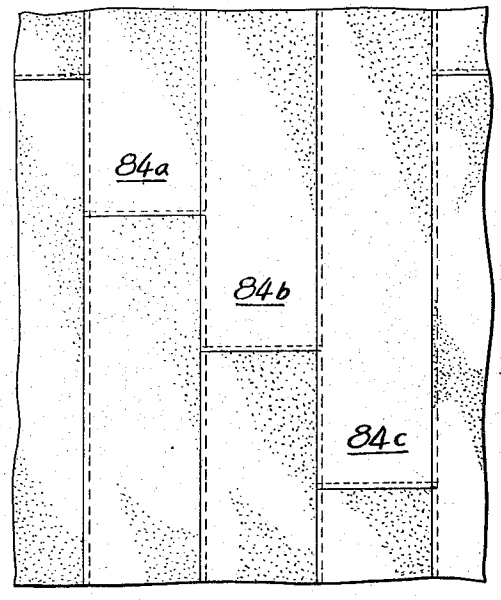


Fig. 19

LIQUID BULK CARRYING SHIP

BACKGROUND

1. Field of the Invention

The present invention is directed to a liquid bulk carrying ship and more particularly to means for preventing spillage of a fluid in liquid bulk carrying ships in case of collision or structural failure.

2. Description of the Prior Art

Liquid bulk vessels, because of physical laws governing free liquid surfaces and surge, are by necessity divided into a number of compartments, reservoirs or cargo carrying tanks. Access between these tanks is restricted to pump lines for loading, discharging, or ballasting, and to steam or electric lines for the activation of heating coils set in the bottom of each tank as necessary. The tanks can be completely closed off, or opened in a direct or articulated manner by automatic or manual valves situated either on deck, or in a central pump room or both. Physical entrance to each tank is made through hatches or through manholes. The tanks are usually centrally vapor vented through the masts, sampson posts and individual vents located on deck. In the event of marine diasters, in the vast majority of cases, a damaged, stranded, or wrecked tanker looses her pollutant cargo progressively as each cargo tank is fractured as the result of pressures built up by the original fracture.

Immediately following a collision, the fractured tank or tanks, may be flooded in order to maintain the proper relative pressure inside the tank with respect to outside water pressure. If not already stopped, the ship should be stopped in the water, and should only be permitted slow movement when buoyancy checks have been made and fractured tanks securely closed off.

Liquid bulk carriers commonly known as tankers have a complex structure made of steel to provide a triple function, that is, (1) the hull must be watertight to keep the vessel seaworthy; (2) the hull must be strong enough to support the tanker without damage under all reasonable conditions of stress, strain and perils of storms at sea; and (3) it must contain the liquid cargo without spillage. Obviously, if pollution does take place, it is caused by a spillage of the pollutant liquid due to the ship breaking open as a result of stranding, hitting a rock or other underwater obstruction or by being in collision with another vessel.

If one examines the record of naval disasters it is interesting to see from information culled from such publications as Lloyd's Casualty Return, that in the last few years, the number of disasters has progressively increased and is approximately as follows:

Merchant ships lost (above 100 tons gross) for all reasons with no separation by type:

1948	210,000 gross tons
1958	350,000 gross tons
1968	770,000 gross tons
1970	640,000 gross tons

Although it would be unreasonable to expect that an unsinkable ship could be designed, it is one of the objects of the present invention to offer a protection in a great number of circumstances in which liquid bulk carriers are damaged. Statistics also indicate that a large quantity of spilled pollutant liquid from tanks are due to minor accidents or leakage from tankers.

SUMMARY OF THE INVENTION

According to the present invention, liquid bulk vessels are provided with a plurality of closed individual reservoirs or tanks, each reservoir is provided with an impermeable elastomeric tailored lining releasably fixed to the inner walls, and this lining is adapted to separate from the walls upon a predetermined minimum external concussive pressure and deformation of the walls of the reservoir. The material used for such a lining is stretched upon the action of the pressure and the deformation, the reduction of volume within this lining forces the liquid contained therein to move outwardly of said tank towards an empty space.

It follows, of course, that if the lining is formed by a bag, the latter must be secured to the walls of the reservoir in such a way as to permit simplicity of fitting and proper security, while at the same time allowing the securing device to part at a precalculated minimum tension since, if the ship suffers a collision and a reservoir is broached by the invasion of the bow of the colliding ship, the resulting shock wave passing through the fluid cargo will tend to rip the bag unless it is permitted to part from the supporting structure and become free to move and be self-supporting. The shock wave is handled so that the displacement of the liquid created by the shock wave is absorbed without equivalent damage to the other side of the ship. The arrangement used in this instance is a piping system leading from each tank to three locations but separated from these locations by rapid acting pressure controlled valves. The three locations in question are (1) the other reservoir of the ship, (2) a ballast tank; (3) up the mast to a significant height and then directed over board. The third alternative is an emergency measure since it is possible to anticipate an impact of such magnitude that immediate dumping to other tanks or other containing quarters cannot be totally absorbed and one must then recognize that to salvage the majority of the cargo, some of it must be jettisoned.

The use of bags fitted in the reservoirs according to the invention is an advantage in existing structures where these structures are not overly complicated. Such bags are also an advantage in older ships where the structure is becoming rather seriously corroded and where it becomes uneconomic to either replace steel that has approached the minimum corrosion margin or to clean steel that is excessively corroded due to certain cargoes which encourage such an attack or deposit.

Another type of lining to be fixed on the inner walls of the reservoir and which is reversed for new construction or ships that have an excessively complicated internal structure, but are young enough to offer a surface that can be considered as clean, is to utilize a new family of elastomeric liquid chemicals that are capable of being sprayed on. Such spray-on processes may be of three parts, the first of which is a special formulation that provides a parting surface of pre-calculated strength between the steel and the second application of chemical; the second application is a chemical of such characteristics as to provide a reasonably elastic high strength which, in fact, provides the basically required objective of the invention; the third application is the final internal coating which is applied for the sole purpose of offering an impervious chemically resistant surface to the liquid being carried.

The first layer has an adhesion to the surrounding steel which is strong enough only to maintain the position of the membrane or layer under normal operating conditions, but weak enough to part from the structure when presented with strong external concussive forces. The material of the second layer must be strong enough and flexible enough so that it will not rupture or fail under reasonable circumstances, such as the withdrawal of supporting structure, and will stretch sufficiently to allow for deformation or opening of the structure. The third layer which is the internal surface of the lining, should not only be impervious to the passage of the transported liquids but also chemically inert and, therefore, not subject to chemical or corrosive attack.

A rapid release system of the liquid with delivery to other areas of containment for liquids that are rapidly displaced as the result of concussion by an intruding or invading vessel or object is also foreseen.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a bulk liquid vessel with the side partly ripped off for showing the reservoirs,

FIG. 2 is a top plan view of the central portion of the ship as illustrated in FIG. 1,

FIG. 3 is A cross-sectional view of a tanker with its side damaged by another ship,

FIG. 4 is a cross-sectional view of the side of a tanker being damaged by a ship,

FIG. 5 is a view similar to FIG. 4 but illustrating an alternative construction of the side of the tanker,

FIG. 6 is a magnified view of the hull of a tanker having a coated lining of elastomers,

FIG. 7 is an enlarged view of a web of the hull illustrated in FIG. 6,

FIG. 8 is a view similar to FIG. 6 illustrating a double hull, the inner hull constituted by an elastic bag fastened to webs connected to the outer hull,

FIGS. 9–13 are side views of various fastenings means for connecting the plastic bag to the outer hull,

FIGS. 14–17 show various means for sealingly connecting a tube through a plate or hull,

FIG. 18 displays a side view of an arrangement for emptying reservoirs of a tanker.

FIG. 19 and 20 illustrate two orthogonal front views of the bag as shown in FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The bulk liquid vessel or tanker **10** illustrated in FIG. 1 has a hull **12**, a mast **14** and a cabin section **16**. The central portion is cut away so as to illustrate the tanks or reservoirs **18–36** located in the hull **12**. These reservoirs are adapted to receive a liquid to be transported by the tanker **10**. Each of these reservoirs has an outlet pipe **18*b*–36*b*** and each of these outlet pipes is connected to a main outlet pipe **40**. This main outlet pipe **40** is connected to a mast pipe **42**.

Each reservoir is also provided with manhole **28*c*–36*c*** as illustrated in FIG. **2**, and **50** illustrated in FIG. **3**. These manholes are used by the operators to go down the reservoirs when cleaning, repairing or general maintenance is needed.

According to the invention, various types of valves may be selectively used above each reservoir, such as

1. Eccentrically balanced two directional butterfly valves, capable of being adjusted to burst open in either direction at a pre-calculated pressure, and also controlled (open or shut) by an external lever, similar to a modification of a Weir-Pacific "Monoseal" valve.

2. A pair of pressure loaded swing check valves, operating uni-directionally in Siamese Branch pipes, similar to a modification of a Mission Duo-Chek Check Valve.

3. A diaphragm insert arranged for easy replacement, designed to rupture in either direction at a precalculated pressure, to be inserted in the main pipeline branch pipe, accompanied by a parallel by-pass pipe of smaller diameter, fitted with a conventional control valve. This smaller pipe used for filling and emptying purposes.

Each secondary outlet pipe **18*b*–36*b*** is provided accordingly at a portion above the reservoir, with a diaphragm valve **52, 54** and **56** of which the diaphragm is laterally removable by a sliding mechanism partially illustrated in FIG. 3 by reference number **54*d*** and in FIG. 2 by reference numbers **36*d*** for reservoirs **36** and **36*a***. These diaphragms **52, 54** and **56** are adapted to close the outlet of each reservoir but upon a predetermined minimum pressure from the liquid in the reservoir will break to let the liquid pass through the outlet pipes **18*b*–36*b*** and through the main pipe **40**. As shown in FIG. **3**, the diaphragm **56** is broken to let the liquid flow upwardly. The tanker which is illustrated in FIGS. **1, 2** and **3** is provided with reservoirs **18–36** which are divided by transverse bulk heads **60** and longitudinal bulk heads **62**.

As it may be seen from FIG. **3**, when the tanker **10** is collided by a ship **100**, the side of the reservoir **64** is crushed and its volume is reduced at a speed corresponding to the collision and the size of the ship **100**. In order to take up the liquid corresponding to the reduction of volume of the reservoir **64**, the liquid moves upwardly through the diaphragm **56** which is broken due to the excessive pressure caused by the liquid and flows into the outlet pipe **50*b*** and through the main outlet pipe **40** (FIG. **2**). In order to take up this transfer of volume, at least one reservoir among the reservoirs **18–36** is empty so as to receive the overflow. The main outlet pipe **40** is also connected to a mast pipe **42** so that any surplus which could not be absorbed by the evacuated reservoirs will be projected into the sea. However, the projection of the liquid into the sea is only in case of emergency and intended only to prevent greater spillage of liquid. It is also expected that if some of the reservoirs are not completely filled with liquids, the main outlet pipe **40** may bring the liquid to one of the outlet pipes **18*b*–36*b*** so as to fill them.

When a ship **100** collides with a tanker **10** such as shown in FIG. **3**, it may be expected that the shock waves and the deformation of the outer hull of the tanker will break open some reservoirs and that spillage may occur. For this purpose, the present invention also includes an inner hull such as shown in FIGS. **4** and **5**.

In FIG. **4**, the ship **100** has broken open the outer hull **70** of the tanker **10**. However, according to the invention, the inner surface of the outer hull **70** is coated with an elastomeric material which is tailored to the hull **70** and which includes the webs **72**. The elastomeric material is represented by reference number **74** which is adapted to separate from the walls of the reser-

voir, these walls being constituted on the lateral side of the ship by the hull **70** and the webs **72.** After the coating **74** has detached from the hull **70** and the webs **72,** it is adapted to stretch sufficiently so as to pick up the compression caused by the prow of the ship **100.** The coating **74** is also adapted to be impermeable to the liquids located inside the reservoir.

In order to obtain these characteristics from the coating **74,** it has been found preferable to have a three-layer coating. The first coating is a primer which has an adhesion to the hull balanced in such a way that the layer will part from the surface rather than break. This is achieved by varying the molecular weight, polarity and degree of cross-linking. The basic polymers which may be used for this primer are vinylchloride-vinyl acetate copolymers, bisphenol A/epichlorhydrin condensates, hexamethylene di-isoyanate adducts, styrene/-butadiene and olefin elastomers, polyvinyl butyral. The peel strength can be varied from 10 psi to over 300 psi. The film thickness of the primer is preferably between 0.002 to 0.008 inch.

The intermediate layer is an elastomeric high solids coating preferably based on long chain polyethers or polyesters cross-linked with di-functional isocyanates. It may also be made of interpolymers of epoxides, acrylics butyl rubber or other rubber like derivatives. These materials cure rapidly and it is possible to tailor make the extension and tensile characteristics. To obtain tensile strengths of the order of 10,000 psi, it would be necessary to reinforce the elastomer with fibers either woven or chopped and sprayed into the coating.

The fibrous and reinforcing materials may include nylon, polyester, fiberglass and glass flakes. The thickness of the intermediate layer is preferably from 0.020 to 0.050 inch depending of the tensile characteristic required. These characteristics vary with the size of the ship, the size of the reservoir, the type of liquid carried and the type of collision which may also be expected.

The final or seal layer provides for the chemical and solvent resistance characteristics. The polymers involved here would be interpolymers of epoxides, urethanes and hydroxyl modified acrylics or a mixture thereof. Also, aromatic isocyanates may be used as cross-linking agents. The film thickness of this layer varies preferably from 0.003 to 0.010 inch.

These layers are expected to be coated by spraying. The copolymers which may be used in this coating may be built from the following monomers and film formers:

Butyl rubber - acrylate esters - methacrylate esters - styrene and it derivatives - 1:2 epoxides - polyisocyanates, both aromatic and aliphatic - polyesters - vinyl monomers e.g., vinyl chloride, vinyl acetate, vinyl alcohol, vinyl acetals - maleic acid and anhydride - fumaric acid - phenoplasts - poly-ethers urea/formaldehyde condensates - malamine/formaldehyde condensates - chlorinated rubber - isomerised rubber - polyamides - polysulphides.

FIG. **6** shows a portion of the contour of a reservoir such as shown in FIG. **4** but in an enlarged scale in which the coating **74** entirely covers the webs **74** and the cross webs **75** and the inner surface of the hull **70** so that when the coating **74** peels off from the webs and the hull, it will form a completely enclosed unit to preserve the liquid contained therein.

FIG. **7** is an enlarged view of a web **72** shown in FIG. **6** having a T-shape, the cutting edges of the two extended arms of the T being covered by a semi-cylindrical protector **71.** These protectors are provided to prevent the elastomers coating from cutting, if too great pressure is exerted over such sharp edges. FIG. **7** also illustrates the primer **73** which will provide the proper adherence between the coating **74** and the metallic web **72.**

FIG. **5** illustrates a different embodiment in which a ship **100** has collided against the side of the tanker **10.** The latter is constituted by a rigid hull **80** inside of which project web plates **82.** A resilient bag **84** is releasably connected to the web plate **82.** According to the embodiment shown in FIG. **5,** the inner ends of the web plates **82** are provided with a rigid socket **86** and the outer surface of the bag **84** is provided with projections **90** adapted to be secured to the socket **86.**

The material used for the bag **84** is the same as the one used for the intermediate and the inner layer of the coating **74** described above concerning FIGS. **4, 6** and **7.**

According to the present invention, the bag **84** is constituted by a plurality of elementary units **84***a*, **84***b*, **84***c* . . . as shown in FIGS. **19** and **20.** These elementary units are provided with the projections on one side thereof and mounted unassembled inside the hull **80.** Subsequently, while in position, these units are sealed to one another in a conventional manner by a worker inside the reservoir.

As it may be seen from FIG. **5,** when a ship **100** hits the tanker **10,** the outer hull is ripped open. The prow of the ship **100** pushes against the bag **84** and disconnects the projections **84** from the sockets **86.** The resiliency and the strength of the bag permits it to change its shape according to the pressure exerted. As explained above, the liquid contained in the reservoir **92** will flow through the outlet pipe located at the top of the reservoir as illustrated in FIG. **3** according to the reduction of volume of the reservoir **92.**

FIG. **8** illustrates an enlarged embodiment of a reservoir according to FIG. **5** in which the bag **84** is installed in its position of normal operation. The bag is releasably fixed to the webs **82** by breakable couplings constituted by a socket **86** in which the projection **88** is releasably held.

FIGS. **9–13** illustrate various embodiments of the releasable couplings used in the embodiment of FIG. **8.**

FIG. **9** illustrates one of these couplings in which the bag **84** is held to the web **82** by a pair of brackets **77** and **79.** These brackets are L-shaped and engage over one another so that when the sidewall of the bag **84** is tilted sufficiently it will unhook itself from the web **82.** The hook **77** is rigidly secured to the web **82** while the hook **79** is permanently fastened to the bag **84.**

FIGS. **10** and **11** illustrate another embodiment of the coupling between the bag **84** and the web **82.** A pair of plates **86**a and **86**b are welded to the web **82** and a single plate **88** is permanently fastened to the bag **84.** The plate **88** is disposed between the two plates **86**a and **86**b and held together by a shear pin **89** passing through the plates. The shearing power of the pin **89** is computed according to the desired retention of the bag to the web **82.** Another embodiment of a combination of a socket and a projection is illustrated in FIGS. **12** and **13** wherein plates **86***c* and **86***d* are outwardly fixed

to the web 82 instead of inwardly as in FIGS. 10 and 11. These various coupling arrangements are used according to the type of structure of the hull and webs 82 and also in view of the desired results. For instance, it may be seen that with the arrangement of FIGS. 12 and 13, the bag 84 may be located closer to the surface 82 and if this surface is extended substantially over the full surface of the bag 84, it will present or reduce small vibrations exerted by the bag 84.

FIGS. 14–16 illustrate various embodiments for providing an appropriate seal between a pipe and a reservoir through which the pipe passes.

FIG. 14 represents the upper part of a reservoir and an outlet pipe of the type shown in FIG. 3 and which is mounted substantially flush with the inner part of the reservoir 101. The coating 104 which is deposited inside the reservoir 101 follows the inner contour of the pipe 102. The upper edge of the coating 104 which enters the pipe 102 is tightened between the upper edge of the pipe 102 and the lower edge of the pipe 106 to form a seal. With this arrangement, the only opening of the bag formed by the coating 104 will remain aligned with the outlet pipe 102 and attached thereto.

FIGS. 15, 16 and 17 illustrate distinct sealing arrangements between a tube 108 and a pannel 110 which is crossed by the tube 108. In the three cases, a sealing ring is foreseen. According to FIG. 15, a space is left between the pannel 110 and the tube 108 and a sealing ring 112 extends around the tube 108 from below the surface of the pannel 110 to its upper surface. The sealing ring 112 passes through the space between the pannel 110 and the tube 108.

According to FIG. 16, the pannel 110 tightly surrounds the tube 108 and is welded thereto. The sealing ring 114 surrounds the tube 108 below the pannel 110. A part of the tube 108 is threaded so as to engage a locking nut 116 which is intended to tighten the sealing ring 114. According to FIG. 17, the sealing 114 is substantially identical to the one of FIG. 16 except that no locking nut is contemplated. The sealing rings are contemplated for drain holes, manholes or the like.

In FIG. 18, the bottom of a reservoir is partially illustrated in section and shows a small amount of liquid between the webs 120. Reservoirs in tankers are usually filled and emptied with a large pipe 122 but when the reservoir must be emptied, such large pipe cannot move in between the webs 120 and even if the pipe 122 could be introduced between the webs 120, the process would be very slow. Furthermore, a pipe having a large diameter would not be very effective near the bottom of the reservoir. Accordingly, in a reservoir such as shown in FIGS. 4, 6 and 18, a main stripping pipe 124 is contemplated to which is connected a plurality of branch pipes 126 reaching to the bottom of each alcove or bay between the webs 120. In order to avoid valving or in order to ensure that, when one alcove or bay has been drained, it could then commence sucking air without detriment of the remaining liquid to be remove, the main stripping pipe 124 is of a decending order of diameter. The tapering of the main stripping pipe from one bay to another is calculated in order to ensure that all branch pipes remove liquid from their individual bay at the same rate of speed. Also, if one branch pipe, by some accident, commences sucking air, the volume of air sucked will not be sufficient as to prohibit the continued activity of the remaining branch pipes which are still required to deliver the liquid remaining in their alcoves.

This system of emptying the reservoir is contemplated because contrary to some previous reservoirs, no apertures can be contemplated through the webs 120 due to the coating 121.

We claim:

1. A liquid carrying tanker comprising a plurality of closed individual reservoirs for receiving and carrying a liquid an ejecting piping system connecting the upper part of each reservoir to an empty space and provided with a rapid acting pressure controlled valve adjacent each said reservoirs, said valve keeping the liquid inside the reservoir from flowing into the ejecting piping system during normal operation, and an impermeable, stretchable, elastomeric lining conforming to and extending throughout the entire inner surface of each reservoir and being releasably secured to the inner walls of said reservoirs, the said lining being secured to said walls by releasable means permitting the same to separate from the walls of any one of the reservoirs upon a predetermined minimum external concussive pressure and deformation of the walls of said one reservoir, the lining being stretched upon said pressure and deformation to decrease the volume within said one reservoir and force the liquid contained therein to open said valve and to flow through said ejecting piping system and towards said empty space.

2. A tanker as recited in claim 1, wherein the said lining is adheringly coated on the walls of each reservoir, the adherence of said lining on the walls of anyone of said reservoirs being adapted to break upon a predetermined minimum pressure and deformation of the walls of said anyone reservoirs.

3. A tanker as recited in claim 1, wherein the lining comprises three superposed layers, a first layer consisting of a primer having a releasable adhesion, a second layer consisting of an elastomeric high solid and a third layer consisting of a protective coating.

4. A tanker as recited in claim 3, wherein the primer is made of a compound selected from the group consisting of vinyl chloride/vinyl acetate copolymers, bisphenol A/epichlorhydrin condensates, hexamethylene di-isoyanate/polyester adducts, styrene/butadiene and olefin elastomers, polyvinyl butyral.

5. A tanker as recited in claim 1, wherein said empty space is a ballast tank, the said ejecting piping system being connected to said ballast tank.

6. A tanker as recited in claim 1, comprising a mast pipe reaching substantially above the reservoirs of the tanker, the said mast pipe being connected to the ejecting piping system.

7. A tanker as recited in claim 1, wherein the lining of each reservoir is made of a plurality of assembled units, sealed together and spaced from the walls of the reservoir and fastening means releasably connecting each unit to said walls.

8. A tanker as recited in claim 7, wherein the fastening means are mechanical couplings adapted to shear or break away from a predetermined minimum pressure.

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