

BUNDED TANK SYSTEM**FIELD OF THE INVENTION**

The present invention relates to a banded tank system for transport and
5 storage of bulk chemicals or liquids. In particular, the invention relates to a
containerised banded tank for transport and/or storage of bulk industrial liquids.

BACKGROUND TO THE INVENTION

The bulk storage of industrial chemicals and in particular liquids, is known and
10 has developed an increasing importance over time due to environmental concerns
that arise due to the risk of escape.

In the past it was common to store bulk chemicals in large underground tanks that
were filled for storage and then pumped out when needed. Underground storage
tanks are less common today due to related leaks and difficulty detecting leaks and
15 the associated environmental risks.

Thus it is becoming increasingly important to have liquids that are used in
commercial, industrial and institutional areas banded to prevent slips, accidents,
spills and pollution.

In addition, during the transport of bulk industrial liquids or chemicals is also
20 desirable to have improved safety measures to protect against slips, accidents, spills
and pollution.

In this specification where reference has been made to patent specifications,
other external documents, or other sources of information, this is generally for the
purpose of providing a context for discussing the features of the invention. Unless
25 specifically stated otherwise, reference to such external documents is not to be
construed as an admission that such documents, or such sources of information, in
any jurisdiction, are prior art, or form part of the common general knowledge in the
art.

It is an object of the present invention to provide an improved banded tank
30 system and/or method of storing or transporting same or to at least provide a useful
choice.

SUMMARY OF THE INVENTION

In one aspect, the present invention broadly consists in a tank system
35 comprising:

a first outer tank having a bottom wall, end walls, enclosing side walls, and an
open top,

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a second inner tank having a bottom wall, end walls, enclosing side walls and a closed top, and including an aperture for filling and/or emptying said inner tank,

said second inner tank being arranged within said first outer tank,

said first outer tank has a volume of at least 110% the volume of said second
5 inner tank, and

said first outer tank being sized to fit inside the confines of an ISO standard 20 foot half height container.

According to a further aspect at least said enclosing side walls of said first outer tank are corrugated.

10 According to a further aspect at least said end walls of said first outer tank are corrugated.

According to a further aspect said bottom wall of said first outer tank is ribbed.

According to a further aspect said bottom wall of said second inner tank is
15 ribbed, and

said ribs of said bottom wall of said second inner tank interlock with said ribs of said bottom wall of said first outer tank.

According to a further aspect wherein the corrugated spaces between the first outer tank and the second inner tank, together comprise at least approximately 10%
20 of the volume of said second inner tank.

According to a further aspect said first outer tank is constructed in a single piece.

According to a further aspect said second inner tank is constructed in a single piece.

25 According to a further aspect said first outer tank has forklift pockets adapted to receive the prongs of a forklift.

According to a further aspect said second inner tank includes a collection point at a lowest region of said bottom wall and the remaining portions of said bottom wall slope towards said collection point.

30 According to a further aspect said collection point is located at approximately the centre of said bottom wall of said second inner tank.

According to a further aspect said aperture in said second inner tank is located at approximately the centre of said closed top.

According to a further aspect said end walls of said second inner tank are
35 substantially planar.

According to a further aspect said side walls of said second inner tank are substantially planar.

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According to a further aspect said corrugated walls of said first outer tank define inner wall portions and outer wall portions, and

wherein neighboring walls of said second inner tank are adjacent and abut said inner wall portions of said first outer tank.

5 According to a further aspect said tank assembly further comprises a lid for covering said aperture in the closed top of said second inner tank.

 According to a further aspect said tank system further comprising a tube extending from the vicinity of said collection point to a location proximate said aperture in the closed top of said second inner tank.

10 According to a further aspect said tube is associated with a lid for covering said aperture in the closed top of said second inner tank.

 According to a further aspect said tanks are positioned adjacent and aligned with each other such that correspondingly adjacent corrugated walls of at least two said first outer tanks contact and interlock with each other.

15 According to a further aspect said tank assembly comprising a plurality of said tanks positioned adjacent and aligned with each other and fitted inside the confines of an ISO standard 20 foot half height container and wherein said plurality is:

- a) two tanks,
- b) three tanks,
- 20 c) four tanks,
- d) five tanks,
- e) six tanks,
- f) seven tanks, or
- g) eight tanks.

25

According to a further aspect said container is a half height high cube container.

 According to a further aspect the total volume of said second inner tanks combined does not exceed approximately 10,000 L.

30 According to a further aspect the volume of each inner tank does not exceed 3,000L.

 According to a further aspect the volume of each inner tank is approximately 2,500L.

 According to a further aspect said lid includes a valve according to any one of the clauses directed to a valve.

35 In a second aspect the invention consists in a valve comprising:
a valve body defining a cavity and having a float translatable therein,
a first aperture in said valve body and in fluid communication with said cavity,

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a second aperture in said valve body and in fluid communication with said cavity,

a passageway around said float and in fluid communication with said first and second apertures,

5 said valve having two operating conditions wherein in a first operating condition said float does not block fluid communication between said first aperture and said second aperture, and

wherein when in said second operating condition said float blocks fluid communication between said first aperture and said second aperture.

10 According to a further aspect said float includes a sealing surface and when in said second operating condition said sealing surface engages with a portion of said valve body to block fluid communication from said passageway to said first aperture.

According to a further aspect said sealing surface includes a resilient element.

15 According to a further aspect said passageway extends between said first aperture and said second aperture.

In a third aspect the invention consists in a container lock comprising:

a shaft having a locking lug at a first end, said shaft being rotatable about a longitudinal axis and translatable along said axis,

20 a lifting arm pivotally mounted about a point intermediate a first end and a second end, and

a link between said second end of said lifting arm and said shaft such that rotating said lifting arm about its pivot point causes said link to translate said shaft.

According to a further aspect a second end of said shaft includes a locking handle.

25 According to a further aspect said lifting arm includes a lifting handle at said first end.

According to a further aspect said shaft is rotatable by at least 90 degrees and rotation of said locking handle rotates said shaft.

30 According to a further aspect said shaft is indexed to prevent rotation when said index is engaged.

According to a further aspect said shaft is indexed at 90 degree intervals.

According to a further aspect said locking lugs are adapted to engage with a corner block of an ISO container.

35 According to a further aspect said container locks are positioned on said container to align and engage with a standard ISO container lock configuration.

According to a further aspect said container comprising two container locks.

According to a further aspect said container comprising four container locks.

According to a further aspect said container locks are located at each corner of the top of said container.

According to a further aspect said container comprising six container locks.

5 In a fourth aspect the invention consists in a method of securing a container including a container lock according to any one of the previous clauses, comprising:

placing said container on a support surface having the standard ISO container lock pattern apertures, such that said container locks are aligned with said apertures,

10 rotating said lifting arm to translate said shaft such that said locking lug enters said aperture,

rotating said shaft through 90 degrees such that said locking lug engages said support surface.

According to a further aspect said step of rotating said lifting arm is carried out by moving said lifting handle through 90 degrees.

15 According to a further aspect said step of rotating said shaft is carried out by moving said locking handle through 90 degrees.

In a fifth aspect the invention consists in a tank system substantially as herein described and with reference to any one or more of Figures 1 to 12.

20 In a sixth aspect the invention consists in a tank assembly substantially as herein described and with reference to any one or more of Figures 1 to 12.

In a seventh aspect the invention consists in a valve substantially as herein described and with reference to any one or more of Figures 16 to 18.

In an eighth aspect the invention consists in a container lock substantially as herein described and with reference to any one or more of Figures 13a to 14b.

25 In a ninth aspect the invention consists in a container substantially as herein described and with reference to any one or more of Figures 11 to 12.

In a tenth aspect the invention consists in a method of securing a container substantially as herein described and with reference to any one or more of Figures 13a to 14b.

30 The term "comprising" as used in this specification and claims means "consisting at least in part of". When interpreting each statement in this specification and claims that includes the term "comprising", features other than that or those prefaced by the term may also be present. Related terms such as "comprise" and "comprises" are to be interpreted in the same manner.

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BRIEF DESCRIPTION OF THE DRAWINGS

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Preferred embodiments of the invention will be described by way of example only and with reference to the drawings, in which:

Figure 1 is a perspective view of an inner tank.

Figure 2 is a side view of the inner tank of Figure 1.

5 Figure 3 is a plan view of the tank shown in Figure 2 sectioned along the line A-A.

Figure 4 is a perspective view of an outer tank.

Figure 5 is a side view of the outer tank of Figure 4.

Figure 6 is a plan view of the tank of Figure 4.

10 Figure 7 is a perspective view of a tank assembly showing the inner tank of Figure 1 within the outer tank of Figure 4.

Figure 8 is a side view of the tank assembly of Figure 7 shown in cross section.

Figure 9 is a view of the tank assembly of Figure 7 illustrating the liquid level when the inner tank is full.

15 Figure 10 is a view of the tank assembly of Figure 7 illustrating the liquid level when the liquid has leaked from the inner tank.

Figure 11 is a plan view showing a plurality of tank assemblies arranged within an ISO container of half height.

Figure 12 is a view of two containerised tank assemblies according to Figure 11 shown stacked one on top of the other.

20 Figure 13a is a front view of a container lock shown with the lock retracted.

Figure 13b is a front view of the container lock of Figure 13a shown with the lock extended.

Figure 14a is a side view of a container lock shown with the lock retracted.

25 Figure 14b is a side view of the container lock of Figure 14a shown with the lock extended.

Figure 15 is front and side views of the locking handle of the container lock of Figure 13 showing the indexing detail.

Figure 16 is a side cross-section view of a lid including float valve.

Figure 17 is a close-up cut-away view of a float vent valve.

30 Figure 18 is an exploded view of the vent valve of Figure 17.

Figure 19 is a perspective view of a bunded tank *enclosed* in an open metallic cage.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

35 With reference to Figures 1 to 3 an inner tank according to one embodiment will be described in detail by way of example.

Inner tank 1 includes a bottom wall 2, end walls 3, enclosing side walls 4, and a closed top 5. The tank is preferably shaped with generally planar walls to form a substantially rectangular volume.

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Closed top 5 includes an aperture 6 for filling and/or emptying tank 1. Preferably aperture 6 is located approximately at a mid-point of closed top 5. In alternative embodiments, a filling and/or emptying aperture may be located in one of the other walls of tank 1, or another position in top 5.

5 The inner tank 1 is preferably formed from a single piece and defines a substantially rectangular volume. For example, it is preferred that the tank is constructed from a suitable polymer material capable of resisting chemical attack from the industrial liquids or chemicals intended to be contained within. For example: Polyethylene (High, Med or Low density), Polypropylene (High or low
10 density), Nylon, Teflon, PTFE, PVDF or blends or combinations thereof. In one preferred embodiment the material is Alkatuff®.

 In preferred polymer embodiments of tank 1, the wall thickness of inner tank 1 is approximately 10-12 mm. In alternative embodiments the tanks may be of a metallic material. For example, Stainless steel, Hastelloy, Aluminium, Titanium or
15 any ferrous metal. In these embodiments the wall thickness may be reduced, for example to approximately 5-7mm.

 One suitable method of constructing inner tank 1 in a single piece is via the method of rotational moulding. This method is particularly preferred where the tanks are large in size. Alternatively, inner tank 1 may be manufactured in a single piece
20 according to other moulding techniques, such as blow moulding or any other suitable techniques.

 Alternatively still, inner tank 1 may be constructed from multiple pieces and joined together via a suitable method such as welding or other forms of fastening that may require the joins to be further sealed such as bolts or rivets etc. In these
25 forms the tank may be constructed from a polymer material or alternatively from a metallic material, or alternatively still from both polymer and metallic parts.

 With particular reference to Figure 3 it is preferred that inner tank 1 has a bottom wall 2 comprising one or more ribs 7. In this context, a rib is intended to mean contoured regions that extend out of plane with respect to the generally planar
30 bottom wall 2.

 Preferably, bottom wall 2 also includes one or more collection points 8. It is preferable that a single collection point 8 is located approximately centrally to bottom wall 2 and/or located at a low region of said bottom wall 2. In most preferred
35 embodiments the collection point 8 is located at the lowest region of bottom wall 2 so that any liquid in inner tank 1 will drain towards the collection point 8. It is also preferred that ribs 7 form drain ways that slope towards collection point 8.

 Inner tank 1 preferably also includes a plurality of lift points (not shown) to aid with gripping and manipulating inner tank 1.

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With reference to Figure 16, inner tank 1 includes a pumping tube 10 made from a non-reactive material extending from the vicinity of collection point 8 to a location proximate the filling and/or emptying aperture 6. The filling and emptying aperture 6 of inner tank 1 is preferably adapted to receive a lid 12 that when
5 engaged hermetically seals tank 1 preventing any unwanted escape of liquid therein.

Preferably, the pumping tube 10 couples with lid 12. In use, inner tank 1 can be filled and/or pumped out via tube 10. It will be appreciated that because tube 10 has its bottom end located in the vicinity of drain point 8 (and the bottom wall 2 of inner tank 1 drain towards the collection point), the inner tank 1 can be pumped
10 almost completely dry from a single location. In addition, tube 10 allows the tank to be filled from the bottom up thereby reducing foam generation which can be a problem when pumping some chemicals into storage tanks.

Lid 12 includes a filling/emptying aperture 17 and is adapted to engage with aperture 6 of inner tank 1 via screw threads 15 around its peripheral edge.
15 Filling/emptying aperture 17 is in fluid communication with tube 10 so that liquid can be pumped in or out via filling tube through lid 12. An O-ring 16 is provided to complete a hermetic seal when lid 12 is engaged with tank 1. Preferably, filling/emptying aperture 14 is adapted to receive an industry standard cam lock fitting for attachment to a flexible hose for the purpose of pumping in or pumping out
20 fluid. Alternatively, any suitable attachment may be accommodated.

In the most preferred embodiments, lid 12 also includes a valve 11 to allow venting and/or intake of air during the filling and/or emptying process respectively. In addition, the valve 11 may also be effective at reducing or elimination spillage (through the vent valve) if the tank is tipped or dropped. A most preferred structure
25 of valve 11 will be described in more detail later. In alternative embodiments, the vent valve may not be part of lid 12.

It is preferred that inner tank 1 also includes one or more drain channels 13 in closed top 5. The drain channels 13 function to direct any liquids spilled on the surface of the closed top 5 around the sides of inner tank 1, and into the bund
30 (described later). It will be appreciated that channels 13, also function to reinforce and stiffen the tank.

At each corner of inner tank 1, there are preferably recesses 14 extending the height of inner tank 1. The function of these corner recesses 14 is to accommodate containerisation and/or an improved locking mechanism to be described later.

35 Outer tank 20 includes a bottom wall 21, end walls 22 and enclosing side walls 23. Preferably the outer tank 20 has an open top. The outer tank 20 is preferably shaped with generally planar walls to form a substantially rectangular volume.

Bottom wall 21 of outer tank 20 also preferably includes one or more ribs 24. The bottom wall 21 is preferably generally planar but with ribs that provide a contour extending out of plane with respect to the generally planar bottom wall 21 as illustrated.

5 The inner outer tank 20 is also preferably formed from a single piece. For example, it is preferred that the tank is constructed from a suitable polymer material capable of resisting chemical attack from the industrial liquids within as described above in respect of the inner tank 1. In preferred polymer embodiments of outer
10 20, the wall thickness is approximately 10-15 mm. Alternatively the outer tank 20 may be constructed of a metallic material or a polymer lined metallic material as described with reference to the inner tank.

 Preferably the bottom wall 21 of outer tank 20 also includes fork lift pockets 25 to aid with lifting outer tank 20 via a fork lift. Preferably ribs 24 provide a number of support surfaces 26 distributed across the bottom wall 21 and these support
15 surfaces 26 are at a height above fork lift pockets 25. This reduces the risk of a fork lift prong that misses pockets 25 and pierces outer tank 20 from also piercing the inner tank 1 arranged within outer tank 21 and supported on support surfaces 26.

 According to one aspect, side walls 23 of outer tank 20 are corrugated. According to another aspect, end walls 22 of outer tank 20 are corrugated. According
20 to a further aspect, end walls 22 and side walls 23 are corrugated.

 The corrugations of side walls 23 and/or end walls 22 provide significant additional stiffness to the outer tank structure. In this context, the corrugated walls of outer tank 20 are intended to mean walls that are generally planar but include corrugations that extend out of plane as illustrated.

25 It is preferable that the corrugations are substantially linear such that the surface is corrugated in one direction only. However, the term corrugated may also encompass more complicated profiles. The importance of the corrugations is that they provide improved stiffness to outer tank 20 and/or that they interact with corresponding corrugations of an adjacent outer tank as described in more detail
30 later.

 Preferably outer tank 20 includes a plurality of lift points (not shown) on side walls 23 or end walls 22 or both. The lift points aid with gripping and manipulating the tank.

 Preferably the outer tank 20 includes a low point 28 located to correspond
35 with collection point(s) 8 of inner tank 1 when assembled together. Most preferably, the location of collection point 8, is aligned with the location of aperture 6, so that the tube 10 can extend directly from one to the other.

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The tank assembly comprising inner tank 1 located within outer tank 20, will now be described in more detail by way of example with particular reference to Figures 7-10.

5 In order to form a bunded tank system, inner tank 1 is placed inside outer tank 20 as shown in Figure 7. One important feature is that the volume of outer tank 20 is at least 110% of the volume of the inner tank 1. It will be appreciated that this means that any leakage from inner tank 1 can be completely contained within the bunding outer tank 20, while still allowing an additional 10% of headroom. In another preferred aspect the bunding ratio is between 110% and 112%.

10 It is preferred that the side walls 4 of inner tank 1 are adjacent and substantially abut the side walls 23 of outer tank 20 as illustrated. That is, the additional 10% volume of outer tank 20 is predominantly provided by the spaces formed by corrugated walls 23.

15 In alternative embodiments (not shown), where end walls 22 are corrugated, the additional 10% volume of outer tank 20 is provided in those corrugation spaces as well.

Similarly, there may be spaces formed between the bottom wall 2 of inner tank 1 and the bottom wall 21 of outer tank 20, that provide some of the additional 10% volume.

20 For these above described embodiments the additional 10% (or 10-12%) volume is provided by the cumulative corrugation and/or ribbed spaces between the inner and outer tanks.

25 Figure 9 illustrates inner tank 1 filled to its nominal maximum capacity level 18 (for example 2,500 litres). Figure 10 illustrates the same volume of liquid in the case where the inner tank 1 has ruptured and the liquid has leaked into the spaces between the inner tank 1 and the outer tank 20. The liquid level 18 is lower due to the bunding ratio being at least 110%.

30 The ribs 7 and 24 of the inner and outer tank respectively also function to give improved rigidity to the tanks and corresponding tank assembly. In addition, the ribs 7, 24 also provide crush zones that can absorb shock without the tanks rupturing if for example the tank and/or tank assembly is dropped. This feature is an important safety aspect of the tank system.

35 Improved rigidity of the tank and bund system is particularly important because the inner and outer tanks 1 and 20 respectively are not cylindrical but rather generally rectangular. Cylindrical tanks are often chosen because of the additional hoop strength achievable. However, a cylindrical tank is less efficient in terms of use of space.

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With reference to Figure 11, a most preferred form of the present tank system includes several tank assemblies (each comprising an inner tank 1 inside an outer tank 20) ganged together adjacent and aligned. In this configuration, adjacent walls of outer tank 20 are arranged to mirror each other so that respective
5 corrugations interlock as illustrated.

This interlocking feature is important as it significantly improves the structural rigidity and strength of the tank system. That is, the corrugated walls are further constrained from bulging or bowing outwards due to pressure from the liquid therein by the adjacent tank and bund structure. It will be appreciated that the interlocking
10 nature achieves improved rigidity and strength while having minimal impact on the efficient use of space. That is, the interlocking shapes allow the storage volume to be maximised (while maintaining at least an additional 10% bund volume (or 10-12% buffer)).

The use of a cylindrical tank, would result in an unnecessarily large bund
15 ratio, and therefore a significantly reduced efficiency in storage volume.

The additional rigidity and strength achieved adds to the overall safety factor of the present tank and bund system. It is preferred that the tank and bund system is manufactured so that the system can be picked up (while full) and maintain its structure without breaking. In particular, the fork lift pockets 25 can be used to lift
20 and manoeuvre the tank and bund system safely.

However, when interlocked with another adjacent and aligned tank and bund system, the combination achieves additional strength and rigidity leading to a better performing and safer system.

In some preferred embodiments the tank and bund system may be contained
25 within an outer shell for protection. For example a wire mesh cage (not shown) may be used to surround one or more tank and bund assemblies. Alternatively, an open metallic cage as shown in Figure 19 may be used.

In another preferred embodiment, the tank and bund system is particularly adapted to fit within a standard ISO container envelope. In particular, Figures 11 and
30 12 show a containerised system including four tank and bund units arranged inside a standard half height (High cube) ISO container envelope. In this configuration the interlocking corrugated walls enable maximisation of the stored volume within the confines of the ISO container. The container walls may be solid (as shown) or alternatively open wire mesh (or combinations of the two).

35 In one embodiment the ISO container includes two tank assemblies.

In another embodiment the ISO container includes three tank assemblies.

In another most preferred embodiment the ISO container includes four tank assemblies.

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In another embodiment the ISO container includes five tank assemblies.

In another embodiment the ISO container includes six tank assemblies.

In another embodiment the ISO container includes seven tank assemblies.

In another embodiment the ISO container includes eight tank assemblies.

5 The containerised banded tank system may be used as a plurality of separate tanks or may be ganged together and used essentially as a single tank. To achieve this, a manifold may be formed by connecting a series of tanks (via lids 12) and pumping through a single point. Alternatively, each individual tank in the containerised assembly may be filled and/or pumped out individually by attaching an
10 appropriate can lock fitting to the respective lid 12 of individual tank. **Vent Valve**
It is preferred that each inner tank 1 includes a valve system to allow venting of gases when the system is being filled or emptied and/or standing. It is preferred that the valve is incorporated into Lid 12. Alternatively, vent valve 11 may be accommodated elsewhere.

15 As liquid is pumped into tank 1 through lid 12 including valve 11, displaced air is evacuated through the valve.

With reference to Figures 16 to 18 the structure and function of valve 11 will be described in more detail.

20 Valve 11 comprises a float 36 located within chamber 37 incorporated in lid 12. At the top of chamber 37 are one or more entry/exit vents 38. Similarly, at the bottom of chamber 37 are one or more entry/exit apertures 39. One or more passageways 40 are formed to allow air to pass around the float into or out of the tank. In one embodiment the passages may be formed by ribs 41 on the exterior surface of the float 36. Alternatively, ribs or protrusions may be formed on the wall
25 of chamber 37.

At the top of float 36 is a sealing portion 42. The sealing portion 42 may also include a compliant seal such as O-ring 43. Valve body 44 includes a correspondingly located and shaped sealing portion 45 for sealing with the float sealing portion 42.

30 In one preferred form, valve 11 is adapted to be screwed into and sealed with lid 12 via threaded portions 46 which engage with threaded portions on an aperture in lid 12.

35 In use, float 36 sits in a lower position (as illustrated in Figure 17) and a passage (or passageways) 40 allows air to flow in both directions from inside the tank to entry/exit 38 in the valve body. It will be appreciated that while filling the tank with liquid, pathway 40 allows evacuation of displaced air. Conversely, while emptying the tank via tube 10, the vent pathways 40 allow air into the tank thereby preventing a vacuum forming.

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At the same time, if the tank is moved, tipped or dropped etc any liquid in tank 1 that enters aperture 39 in the bottom of the valve body will immediately lift the float upwards until float sealing portions 42 seals with corresponding valve sealing portions 45. This effectively blocks the passageways through the valve body 44 and prevents any liquid from escaping. As soon as the liquid pressure forcing the float upwards subsides, the float 36 can fall back to its lower position re-opening the two way vent valve 11.

Pipe 10 works in conjunction with valve 11 to allow filling and emptying as well as providing surge protection. That is, spills are prevented if the unit is lifted into place, dragged at an angle or unexpectedly dropped while loading or unloading. The valve 11 allows lid 12 to remain securely in place throughout.

An advantage of the containerised bunded tank system is that the same system can function as both an efficient storage system and a transportation system. The containerisation of the tank system according to ISO specifications allows seamless integration into existing transport logistics operations. At the same time, the transport of dangerous industrial liquids achieves additional safety by being bunded throughout. The addition of an ISO container around the outside of the individually bunded tank modules also provides an extra layer of safety containment.

The containerised tank system as described can also perform the function of storage for dangerous industrial liquids. For example, short or long term storage can be efficiently achieved by stacking containers as shown in Figure 12. Because the containerised system is self bunded, it is not necessary to store bulk liquid tanks in special facilities with external bunding walls. In addition, the stackability of the containerised bunded tank system allows significant flexibility for manoeuvring the containers for storage in various configurations.

Container Locks

In a further aspect an improved locking mechanism will be described with reference to Figures 13-15.

The container locking mechanisms are adapted to work with other existing ISO container locking systems to allow normal locking methods for both land and sea. However, when desirable, the improved locking mechanism can be used to lock a container onto another object including ISO corner blocks arranged according to the ISO layouts (such as another container etc).

Locking mechanism 50 comprises a shaft 51 having a locking lug 52 at one end. Shaft 51 is rotatable about its longitudinal axis and translatable along its longitudinal axis. Lifting arm 53 is pivotally mounted about a point 54 intermediate its ends. Link 55 is provided between one end of lifting arm 53 and shaft 51, and is

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preferably pin jointed to each. As shown in Figure 14, link 55 is joined to shaft 51 via collar 56.

As illustrated in Figures 13 and 14, locking mechanism 50 is arranged within channel 58 such that in both its locked mode and unlocked mode, the assembly fits
5 within the confines of channel 58.

Channel 58 is located adjacent and aligned with corner block 57. Corner block 57 is preferably an ISO standard corner block for an ISO container. It will be appreciated that channel 58 and corner block 57 are to be located on a container according to the standard ISO pattern. For example, Figure 12 shows channel 58
10 located at each corner of an ISO container to enable the lower container to lock onto the corresponding corner blocks of the upper container.

It is preferred that the lower corners of the container do not contain locking mechanism 50 in order that a traditional locking mechanism may engage with the lower corner blocks.

Figures 13a and 14a illustrate locking mechanism 50 in an unlocked position. In this position, lifting handle 60 is in its upper position while locking lug 52 is in its lower unlocked position. In order to initiate the first stage of the locking process, lifting handle 60 is pulled downwards in direction of arrow 61 as shown in Figure 14a. This raises shaft 51 and corresponding locking lug 52 upwards until the lug 52
15 protrudes into the corner block of an adjacent upper container 62. When in this position, locking handle 59 is used to rotate shaft 51 and corresponding locking lug 52 through 90 degrees. As illustrated in Figure 14b, in this position locking lug 52 engages with corner block 62 and completes the locking process.
20

It will be appreciated that the locking mechanism 50 can be unlocked by reversing the above described process.
25

Use of locking mechanism 50 can be achieved without the need for any special handling of the container system. When not in use, locking mechanism 50 is located sufficiently away from the corner blocks to allow use of all normal lifting and locking equipment currently in use around the world. The only difference in
30 configuration of the upper corner blocks of the locking mechanism compared to standard ISO corner blocks is an additional aperture to allow the locking lug to recede into channel 58.

The locking mechanism 50 provides a useful alternative to allow any container including them to have a self contained locking mechanism to adjacent containers
35 etc.

With reference to Figure 15 it is preferred that locking handle 59 includes an indexing mechanism. That is, a mechanism that allows shaft 51 to rotate through 90

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degrees in an indexable manner. It is most preferred that shaft 51 can be indexed at four locations around a full 360 degree rotation (i.e. at 90 degree intervals).

For example, indexing may be achieved by including an indexing member 65 rigidly supported on shaft 51 and including at least one indexing lug 63. A
5 corresponding stationary member including indexing slot 64 is provided and located such that indexing lugs 63 can engage with indexing slots 64 at 90 degree intervals. It is preferred that the indexing mechanism is biased into a locking position to prevent inadvertent unlocking of lug 52 once the locking mechanism is set.

Alternatively, it would be appreciated that other indexing methods may be
10 utilised.

The foregoing description of the invention includes preferred forms thereof. Modifications may be made thereto without departing from the scope of the invention as defined by the accompanying claims.

CLAIMS

1. A tank system comprising:
 - a first substantially rectangular outer tank having a bottom wall, end walls, enclosing side walls, and an open top, wherein at least the enclosing side walls or the
 - 5 end walls of said first outer tank are corrugated, and said corrugated walls of said first outer tank define inner wall portions and outer wall portions,
 - a second substantially rectangular inner tank having a bottom wall, end walls, enclosing side walls and a closed top, and including an aperture for filling and/or emptying said inner tank,
 - 10 said outer tank and said inner tank both having generally planar walls, said second inner tank being arranged within said first outer tank, and wherein neighboring walls of said second inner tank are adjacent and abut said inner wall portions of said first outer tank,
 - said first outer tank has a volume of at least 110% the volume of said second
 - 15 inner tank, and
 - said first outer tank being sized to fit inside the confines of an ISO standard container.
2. A tank system as claimed in claim 1, wherein the ISO standard container is a
- 20 20 foot half height container.
3. A tank system as claimed in claim 1 or claim 2, wherein the corrugations of said corrugated walls are parallel to the vertical axis of the tank in use.
- 25 4. A tank system as claimed in any one of the preceding claims, wherein said bottom wall of said first outer tank is ribbed.
5. A tank system as claimed in claim 4, wherein said bottom wall of said second inner tank is ribbed, and
- 30 said ribs of said bottom wall of said second inner tank interlock with said ribs of said bottom wall of said first outer tank.
6. A tank system as claimed in any one of the preceding claims, wherein the corrugated spaces between the first outer tank and the second inner tank, together
- 35 comprise at least approximately 10% of the volume of said second inner tank.
7. A tank system as claimed in any one of the preceding claims, wherein said first outer tank is constructed in a single piece.

8. A tank system as claimed in any one of the preceding claims, wherein said second inner tank is constructed in a single piece.
- 5 9. A tank system as claimed in any one of the preceding claims, wherein said first outer tank has forklift pockets adapted to receive the prongs of a forklift.
- 10 10. A tank system as claimed in any one of the preceding claims, wherein said second inner tank includes a collection point at a lowest region of said bottom wall and the remaining portions of said bottom wall slope towards said collection point.
11. A tank system as claimed in any one of the preceding claims, wherein said collection point is located at approximately the centre of said bottom wall of said second inner tank.
- 15 12. A tank system as claimed in any one of the preceding claims, wherein said aperture in said second inner tank is located at approximately the centre of said closed top.
- 20 13. A tank system as claimed in any one of the preceding claims, wherein said end walls of said second inner tank are substantially planar.
14. A tank system as claimed in any one of the preceding claims, wherein said side walls of said second inner tank are substantially planar.
- 25 15. A tank system as claimed in any one of claims 1 to 14, wherein said tank assembly further comprises a lid for covering said aperture in the closed top of said second inner tank.
- 30 16. A tank system as claimed in claim 10 or claim 11, further comprising a tube extending from the vicinity of said collection point to a location proximate said aperture in the closed top of said second inner tank.
- 35 17. A tank system as claimed in claim 16, wherein said tube is associated with a lid for covering said aperture in the closed top of said second inner tank.
18. A tank system as claimed in any one of claims 1 to 17, wherein said tank is surrounded on at least 5 sides by an open wire mesh cage.

19. A tank assembly comprising a plurality of tanks as claimed in any one of the preceding claims when dependent on claim 1, wherein said tanks are positioned adjacent and aligned with each other such that correspondingly adjacent corrugated walls of at least two said first outer tanks contact and interlock with each other.

20. A tank assembly as claimed in claim 19, comprising a plurality of said tanks positioned adjacent and aligned with each other and fitted inside the confines of an ISO standard 20 foot half height container and wherein said plurality is:

- a) two tanks, or
- b) three tanks, or
- c) four tanks, or
- d) five tanks, or
- e) six tanks, or
- f) seven tanks, or
- g) eight tanks.

21. A tank assembly as claimed in claim 20, wherein said container is a half height high cube container.

22. A tank assembly as claimed in any one of claims 19 to 21, wherein the total volume of said second inner tanks combined does not exceed approximately 10,000 L.

23. A tank assembly as claimed in any one of claims 1 to 19, wherein the volume of each inner tank does not exceed 3,000L.

24. A tank assembly as claimed in any one of claims 1 to 19, wherein the volume of each inner tank is approximately 2,500L.

25. A tank assembly as claimed in claim 15 or claim 17, wherein said lid includes a valve according to any one of claims 26 to 29.

26. A tank assembly as claimed in any one of claims 20 to 25 wherein said tanks are surrounded on at least 3 sides by an open wire mesh cage.

27. A container lock comprising:

a shaft having a locking lug at a first end, said shaft being rotatable about a longitudinal axis and translatable along said axis,

a lifting arm pivotally mounted about a point intermediate a first end and a second end, and

5 a link between said second end of said lifting arm and said shaft such that rotating said lifting arm about its pivot point causes said link to translate said shaft.

28. A container lock as claimed in claim 27, wherein a second end of said shaft includes a locking handle.

10 29. A container lock as claimed in claim 27 or claim 28, wherein said lifting arm includes a lifting handle at said first end.

30. A container lock as claimed in any one of claims 27 to 29, wherein said shaft is rotatable by at least 90 degrees and rotation of said locking handle rotates
15 said shaft.

31. A container lock as claimed in any one of claims 27 to 30, wherein said shaft is indexed to prevent rotation when said index is engaged.

20 32. A container lock as claimed in claim 31, wherein said shaft is indexed at 90 degree intervals.

33. A container lock as claimed in any one of claims 27 to 32, wherein said locking lugs are adapted to engage with a corner block of an ISO container.
25

34. A container comprising one or more container locks according to one of claims 27 to 33, wherein said container locks are positioned on said container to align and engage with a standard ISO container lock configuration.

30 35. A container according to claim 34, comprising two container locks.

36. A container according to claim 34, comprising four container locks.

37. A container according to claim 36, wherein said container locks are located at
35 each corner of the top of said container.

38. A container according to claim 34, comprising six container locks.

39. A method of securing a container including a container lock according to any one of claims 27 to 38, comprising:
placing said container on a support surface having the standard ISO container lock pattern apertures, such that said container locks are aligned with said apertures,
5 rotating said lifting arm to translate said shaft such that said locking lug enters said aperture,
rotating said shaft through 90 degrees such that said locking lug engages said support surface.
- 10 40. A method of securing a container including a container lock according to claim 39, wherein said step of rotating said lifting arm is carried out by moving said lifting handle through 90 degrees.
- 15 41. A method of securing a container including a container lock according to claim 39 or claim 40, wherein said step of rotating said shaft is carried out by moving said locking handle through 90 degrees.