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DRAWINGS ATTACHED

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- (72) The inventor(s) of this invention in the sense of being the actual deviser(s) thereof within the meaning of sect. 16 of the Patents Act, 1949 is/are MOHAMED RUHOLAH YAZDANI KASSRAVI (known as RUHOLAH YAZDANI) of Mount Carmel Rubber Factory Limited, P.O. Box 1701, Dar es Salaam, United Republic of Tanzania, a Persian Subject.

(54) CARGO CONTAINERS

(71) I, MOHAMED RUHOLAH YAZDANI KASSRAVI (known as RUHOLAH YAZDANI) of Mount Carmel Rubber Factory Limited, P.O. Box 1701, Dar es Salaam, United Republic of Tanzania, a Persian subject, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to cargo containers and in particular it relates to a cargo container suitable for the bulk transportation or storage of liquids such as petrol, oil, milk, liquid fertiliser, liquid chemicals, water or the like.

Liquids are normally transported in bulk, where the use of a pipe line is impracticable, in vehicles, aircraft, or ships fitted with rigid tanks. One of the major factors contributing to the expense of transporting liquids in bulk in such specially constructed tankers is that, once having delivered their loads, whether by sea, by air, by road or by rail, they must usually make the return trip empty.

It is an object of the present invention to provide a cargo container which may be fitted to a vehicle such as a lorry, the vehicle being capable of carrying either a liquid cargo or a useful load of solid material when the container is empty of liquid.

According to the present invention there is provided a cargo container comprising

- (a) a rigid base,
- (b) rigid protective outer walls which together with the rigid base define a cargo space,
- (c) a fluid-tight vessel within the cargo space, said vessel having flexible fluid impermeable side walls and a rigid protective shield movable on expansion and contraction of the

vessel from an inner position of the shield corresponding to the collapsed condition of the vessel to an outer position of the shield corresponding to the expanded condition of the vessel,

and (d) spacer means within the vessel adapted to co-operate with said shield to define said inner position and to provide a dead space behind said shield in said inner position,

said flexible side walls having in all positions of the shield a corrugated conformation to cause the side walls to collapse in concertina-like fashion and to pack away behind the shield in said dead space in the collapsed condition of the vessel, and said flexible side walls being supported against pressure from within said vessel, when said vessel is expanded, by said rigid outer walls.

A man-hole may be provided in the shield to permit access to the interior of said vessel. The container may have shield movement limiting means to define said outer position and to limit further outward movement of the shield beyond said outer position, such shield movement limiting means, in a particularly preferred form including an inwardly directed flange fast with the rigid outer walls. The shield movement limiting means may include a plurality of pins adapted to engage corresponding locating holes, the pins being attached to said outer walls and the holes being provided in the shield or vice versa. Bracing means may be provided to secure the shield in its inner position; such bracing means may be adjustable so as to limit further outward movement of the shield when it occupies a position intermediate its inner and outer positions. The bracing means may co-operate with the pins and the holes to secure the shield in the desired position.

[Price 5s. 0d. (25p)]



In a preferred form said protective shield comprises a reinforced platform on top of the said expansible vessel, said platform being movable in a substantially vertical direction between a lower position corresponding to the unexpanded configuration of said vessel and an upper position.

The base of the cargo container may itself form part of a lorry or railway truck or other form of land, sea or air transport. Alternatively the container may be a separate entity which can be secured to or loaded on or in the vehicle or other form of transport by which it is to be conveyed.

In order that the invention may be clearly understood and readily carried into effect one preferred embodiment thereof will now be described with reference to the accompanying semi-diagrammatic drawings, wherein:—

Fig. 1 shows a partially cut away perspective view of a cargo container with its platform in the upper, erected position,

Fig. 2 shows a cross section on the line II—II of Fig. 1,

Fig. 3 shows a cross section on the line III—III of Fig. 2 with the platform in the lower, collapsed position, and

Fig. 4 shows a detail view of Fig. 3.

Referring to the drawings, the cargo container is supported on a pair of longitudinal girders 10 which may form part of the chassis of a vehicle (the rest of which is not shown). A series of timber cross beams 12 are fixed across the girders 10 and at their ends the beams 12 have bearing plates 13 which carry upstanding members 14 to provide a vertical framework to which cladding panels 16 are welded to form rigid outer walls to the container. Members 14 are secured to brackets 15 by bolts 17, brackets 15 also being bolted to beams 12. Reference numerals 18 indicate intermediate reinforcing members to which cladding panels 16 are also welded.

A series of longitudinal struts 20 are secured to the cross members 12 and on these struts is mounted a rigid base plate 22. Base plate 22 serves as the bottom plate of a tank whose said side walls 24 are made of a flexible fluid impermeable material, such as oil-resisting rubber, and are pleated so as to cause the side walls 24 to collapse in concertina-like fashion. The tank has a roof which is formed by a movable platform 26 which acts as a rigid protective shield for the tank and is reinforced so as to be capable of carrying a load and withstanding the pressure of the liquid inside the tank. The movable platform 26 may slide up and down inside the rigid outer walls which serve to guide it. The inner surface of the outer walls is made as smooth as possible to minimise the possibility of the flexible side walls 24 being punctured by chafing during movement of the vehicle or during loading or unloading.

As can be seen from the drawings, the side walls 24 retain their corrugated conformation when the platform 26 is in its upper position.

On top of the base plate 22 there are mounted a series of transverse girders 28 (two of which can be seen in Fig. 1 of the drawings). These girders 28 provide a firm support for the movable platform 26 when it is in its lower, collapsed position (as shown in Figs. 3 and 4 of the drawings).

To the underside of movable platform 26 are secured a number of channel members 30. As shown in the drawings these are formed by welding together two flanged Z-sections; they may alternatively be one-piece channel sections without either the internal flanges 32 or the outer flanges 34. At corresponding points immediately beneath the channel members 30 the girders 28 are fitted with pads 36 of oil-resistant rubber. Thus, when the platform 26 is in its lower, collapsed position, it is spaced from the base plate 22 and the channel members 30 rest on the rubber pads 36 which serve to absorb shocks and minimise vibration of the platform 26 when the vehicle is in motion.

The combined height of the girders 28 and the channel members 30 permits the flexible side walls 24 to pack away in concertina fashion beneath the movable platform 26 in the dead space between the platform 26 and the base plate 22.

The top ends of the members 14 are connected by box section girders 38, on top of which are secured Z-section members 40. Portions 42 of members 40 form an internal flange running around the inside of the upper edge of the rigid outer walls. A strip 44 is welded to the members 40. Tie bars 45 are bolted to the Z-section members 40 to connect the top edges of the outer walls to brace them, particularly when the container is part empty and the platform is in an intermediate position. They can be removed if desired when the container is full or is completely empty.

At intervals around the internal flange formed by portions 42 are mounted a series of downwardly projecting pins 46 (best seen in Fig. 4). The platform 26 has a corresponding series of holes 48 around its periphery into which the pins 46 may engage when the platform 26 is in its upper, erected position (as shown in Figs. 1 and 2) to locate the platform 26 and limit further upward movement thereof.

A number of composite adjustable bracing members are provided for use when the tank is not full; each of these adjustable bracing members has three parts, an upper part 50 with a socket into which a pin 46 on the flange may fit, a tubular middle part 52, and a lower part 54 which incorporates a jack and has a peg 56 to fit in the hole 48 in the platform 26 corresponding to the

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chosen pin 46. Middle parts 52 of various lengths are provided so that the platform 26 may be secured at its lower position (with the longest middle part 52 as shown in Figs. 3 and 4) by suitable adjustment of the jack or located at any position intermediate its erected and collapsed positions with the aid of shorter middle parts 52. The jack of lower part 54 can be extended to the desired height by adjustment of the nut 56. As can be seen from Fig. 4 a spigot on the bottom end of upper part 50 fits into the top end of tubular middle part 52 and a spigot on the lower part 54 fits into its bottom end so that the composite adjustable bracing member serves to locate the platform 26 and to prevent further upward movement thereof.

Fig. 4 also shows the method of effecting a seal between the flexible side walls 24 and the platform 26 and base plate 22 respectively. The lower edge portions of the flexible side walls 24 are clamped between the base plate 22 and a clamping strip 58 by means of spaced bolts 60. (The arrangement is similar at the upper edge portions of the flexible side walls 24). Both the upper and lower edge portions of the flexible side walls 24 are reinforced with strips of nylon- or cord-reinforced rubber. Rubber pads 59 are provided around the edges of the platform 26 to prevent damage either to the platform or to the outer walls.

A man-hole 61 is provided in the platform 26 to permit of access to the inside of the tank for inspection, cleaning or repair.

The liquid inlet pipe leads up through the base plate 22 and its outer end (see Fig. 1) is fitted with a 2 1/2" gate valve 62, a pressure gauge 64 and a pressure relief valve (not shown). Except while the tank is being filled or emptied, the outlet is protected by a screw-on brass cap 66. The fill the tank a hose can be coupled to the outer end of the inlet pipe and liquid (e.g. oil) pumped in.

The tank is also provided with an air vent pipe, the outlet of which is fitted with a 3/4" valve 68. This air vent pipe is connected to a nipple in the base plate 22 and a flexible hose 70 leads up from the nipple to the platform 26 where it is connected to an inverted U-pipe 72, the free end of which is flush with the underside of the platform. Conveniently U-pipe 72 is mounted in the man-hole 61. At about its mid point the flexible hose 70 passes through the short metal sleeve 74 which has an elbow bend in it; one end of a helical spring 76 is attached to sleeve 74 and the other end is attached to the underside of platform 26. This spring 76 is so positioned that when the platform 26 is in its lower, collapsed position the flexible pipe 70 is stowed between the platform 26 and the based plate 22 so however as not to be borne upon by any spacing or load bearing member, such as a girder 28, and to prevent

the flexible pipe 70 being damaged by being nipped between the girder 30 and the girder 28 or becoming entangled with the flexible side walls 24.

With gate valve 62 open and valve 68 shut the tank can be filled through the liquid inlet pipe. As the tank fills the flexible walls 24 straighten and the platform 26 rises until the pins 46 engage in the holes 48 to hold the platform firmly in position. (The adjustable bracing members constituted by the parts 50, 52 and 54 are, of course, removed during the filling operation). The valve 68 is then opened and filling is continued until all the air has been expelled from the tank. Finally valve 68 is closed and more liquid is pumped in until the correct pressure is reached at which the corrugations of the flexible side walls 24 are pressed against the cladding panels 16 and are supported against pressure from within the tank by the outer walls. The gate valve 62 is then closed. If the tank is correctly filled and substantially air free, slopping and surging of liquid within the tank is minimised with the consequent minimisation of the danger to the stability of the vehicle.

When the tank vehicle with its full load reaches its destination, the contents of the tank can be discharged through the valve 62, the air release valve 68 being opened to permit the tank to be drained to the fullest extent.

Since the adjustable bracing members are provided with a variety of middle parts 52, the platform 26 can be secured at positions intermediate its upper, erected position and lower collapsed position by bracing the platform against the pressure within the tank. For example there may be three middle parts 52 which correspond to the tank being 1/4, 1/2 and 3/4 full respectively. Thus a lorry fitted with the illustrated container can make a series of calls and make deliveries of liquid at each stop. After each delivery the platform can be secured in position by choosing the appropriate middle part 52 and adjusting the jack 54 and the slopping and surging of liquid in the tank can be minimised however much liquid the tank contains.

When the platform 26 is secured in its lower, collapsed position, the lorry is ready to be loaded, like any other lorry, with any desired solid material such as copper ingots on the top of the platform 26. A door 78 in the end wall of the housing can be opened to facilitate the loading and off-loading of solid material on to the lorry.

The flexible side walls 24 are made from a material chosen to suit the liquid that it is intended to transport, and they retain their corrugated conformation when the platform is in its upper position and the tank is fully loaded. Thus if, for example, the tank is intended to carry oil, the flexible side walls

should be made of the best available grade of oil resisting rubber. Alternatively, the flexible side walls may be made of reinforced rubber or of a flexible plastics material. Alternatively the side walls may be made from flexible steel sheets. It is true that the life of the tank may be less than the life of a rigid metal tank but this disadvantage will usually be compensated by the fact that the lorries may carry a useful load both on the outward and return trips.

Since the flexible tank is inside a metal housing, it is protected from rough handling, sunshine and the impact of flying stones, which are particularly a potential danger on rough roads. In addition loading and unloading is simplified since the tank is a fixed part of the vehicle.

It is envisaged that the pressure inside the tank when it is fully loaded should be about 2.5 lbs. per square inch. It is possible to test whether or not the tank has a leak in it and to check that the valves are properly closed by pressurizing the tank with air to a pressure of about 5 lbs. per square inch before it is filled with the liquid; if the tank has a leak then the pressure inside the tank will gradually drop.

In the illustrated embodiment the bolts 17 can be undone all round the container to allow the outer walls to be removed as a complete unit in order to permit access to the flexible side walls 24. If there is a hole in a flexible side wall this can be repaired with a hot patch whilst the platform is supported in some suitable way in its upper position, the man hole 61 permitting a man to enter the tank for this operation. Other forms of container can be made in which the side walls can be removed individually by undoing the bolts 17 along one side only.

If desired a ship or other bulk cargo carrier may be constructed in which there are a number of cargo containers in accordance with the invention of the appropriate size (e.g. 2, 3 or more). In this case each cargo container can be put in a separate compartment, the compartments being separated by rigid walls which, when the platforms of adjacent containers are in their lower, collapsed positions, can be hinged out of the way against the rigid side walls or can be hinged so as to lie flat against the platforms.

In the case of a container intended for carriage upon, or incorporation into, a railway truck it may be more convenient to provide a door (corresponding to door 78 of the container of the drawings) in one of the longer side walls rather than in the narrower end wall in order to facilitate loading of the truck with solid materials.

Where a container is intended for carriage by air or for incorporation into an aircraft, the rigid parts should be made of a suitable light material such as duraluminium.

Instead of making the container with a substantially rectangular horizontal cross-section it would be possible, and in some cases desirable, to make a container having a circular cross-section with cylindrical outer walls and a circular platform.

For some applications it would be possible to construct a cargo container similar to the illustrated container but in which the "platform" and the "base" are arranged substantially vertically and the movement of the "platform" relative to the "base" is in a horizontal direction. In such an arrangement it would be one of the rigid outer walls that is reinforced so as to be capable of carrying a load and the "platform" (or rigid protective shield) need not be reinforced. For the avoidance of doubt it is hereby stated that it is intended that such constructions should fall within the scope of the invention.

WHAT I CLAIM IS:—

1. A cargo container comprising
 - (a) a rigid base,
 - (b) rigid protective outer walls which together with the rigid base define a cargo space,
 - (c) a fluid-tight vessel within the cargo space, said vessel having flexible fluid impermeable side walls and a rigid protective shield movable on expansion and contraction of the vessel from an inner position of the shield corresponding to the collapsed condition of the vessel to an outer position of the shield corresponding to the expanded condition of the vessel,
 - and (d) spacer means within the vessel adapted to co-operate with said shield to define said inner position and to provide a dead space behind said shield in said inner position,

said flexible side walls having in all positions of the shield a corrugated conformation to cause the side walls to collapse in concertina-like fashion and to pack away behind the shield in said dead space in the collapsed condition of the vessel, and said flexible side walls being supported against pressure from within said vessel, when said vessel is expanded, by rigid outer walls.

2. A cargo container according to claim 1, in which shield movement limiting means are provided to define said outer position and to limit further outward movement of the shield beyond said outer position.

3. A cargo container according to claim 2, in which said shield movement limiting means include an inwardly directed flange fast with the rigid outer walls.

4. A cargo container according to claim 2 or claim 3, in which said shield movement limiting means include a plurality of pins adapted to engage in corresponding locating holes, the pins being attached to said outer

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Since the flexible tank is inside a metal housing, it is protected from rough handling, sunshine and the impact of flying stones, which are particularly a potential danger on rough roads. In addition loading and unloading is simplified since the tank is a fixed part of the vehicle.

It is envisaged that the pressure inside the tank when it is fully loaded should be about 2.5 lbs. per square inch. It is possible to test whether or not the tank has a leak in it and to check that the valves are properly closed by pressurizing the tank with air to a pressure of about 5 lbs. per square inch before it is filled with the liquid; if the tank has a leak then the pressure inside the tank will gradually drop.

In the illustrated embodiment the bolts can be undone all round the container to allow the outer walls to be removed as a complete unit in order to permit access to the flexible side walls. If there is a hole in a flexible side wall this can be repaired with a hot patch whilst the platform is supported in some suitable way in its upper position, the man hole permitting a man to enter the tank for this operation. Other forms of container can be made in which the side walls can be removed individually by undoing the bolts along one side only.

If desired a ship or other bulk cargo carrier may be constructed in which there are a number of cargo containers in accordance with the invention of the appropriate size (e.g. 2, 3 or more). In this case each cargo container can be put in a separate compartment, the compartments being separated by rigid walls which, when the platforms of adjacent containers are in their lower, collapsed positions, can be hinged out of the way against the rigid side walls or can be hinged so as to lie flat against the platforms.

In the case of a container intended for carriage upon, or incorporation into, a railway truck it may be more convenient to provide a door (corresponding to door 78 of the container of the drawings) in one of the longer side walls rather than in the narrower end wall in order to facilitate loading of the truck with solid materials.

Where a container is intended for carriage by air or for incorporation into an aircraft, the rigid parts should be made of a suitable light material such as duraluminium.

Instead of making the container with a substantially rectangular horizontal cross-section it would be possible, and in some cases desirable, to make a container having a circular cross-section with cylindrical outer walls and a circular platform.

For some applications it would be possible to construct a cargo container similar to the illustrated container but in which the "platform" and the "base" are arranged substantially vertically and the movement of the "platform" relative to the "base" is in a horizontal direction. In such an arrangement it would be one of the rigid outer walls that is reinforced so as to be capable of carrying a load and the "platform" (or rigid protective shield) need not be reinforced. For the avoidance of doubt it is hereby stated that it is intended that such constructions should fall within the scope of the invention.

WHAT I CLAIM IS:—

1. A cargo container comprising
 - (a) a rigid base,
 - (b) rigid protective outer walls which together with the rigid base define a cargo space,
 - (c) a fluid-tight vessel within the cargo space, said vessel having flexible fluid impermeable side walls and a rigid protective shield movable on expansion and contraction of the vessel from an inner position of the shield corresponding to the collapsed condition of the vessel to an outer position of the shield corresponding to the expanded condition of the vessel,
 - and (d) spacer means within the vessel adapted to co-operate with said shield to define said inner position and to provide a dead space behind said shield in said inner position,

said flexible side walls having in all positions of the shield a corrugated conformation to cause the side walls to collapse in concertina-like fashion and to pack away behind the shield in said dead space in the collapsed condition of the vessel, and said flexible side walls being supported against pressure from within said vessel, when said vessel is expanded, by rigid outer walls.

2. A cargo container according to claim 1, in which shield movement limiting means are provided to define said outer position and to limit further outward movement of the shield beyond said outer position.

3. A cargo container according to claim 2, in which said shield movement limiting means include an inwardly directed flange fast with the rigid outer walls.

4. A cargo container according to claim 2 or claim 3, in which said shield movement limiting means include a plurality of pins adapted to engage in corresponding locating holes, the pins being attached to said outer

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walls and the holes being provided in the shield or vice versa.

5. A cargo container according to any one of claims 1 to 4, in which bracing means are provided to secure the shield in its inner position.

6. A cargo container according to any one of the preceding claims in which adjustable bracing means are provided to limit further outward movement of the shield when it occupies a position intermediate its inner and outer positions.

7. A cargo container according to claim 4, in which bracing means are provided to secure the shield in its inner position and in which said bracing means are adapted to co-operate with said pins and corresponding holes.

8. A cargo container according to any one of the preceding claims, in which said protective shield comprises a reinforced platform movable in a substantially vertical direction between said inner and outer positions.

9. A cargo container according to any one of the preceding claims, in which a man hole is provided in the shield to permit access to the interior of said vessel.

10. A cargo container according to any one of the preceding claims, in which a door is provided in said outer walls.

11. A cargo container according to any one of the preceding claims, in which said flexible walls are made of oil-resisting rubber.

12. A cargo container according to any one of claims 1 to 10, in which said flexible walls are made of rubber having a flexible reinforcement.

13. A cargo container according to any one of claims 1 to 10 in which said flexible walls are made of a flexible plastics material.

14. A cargo container according to any one of the preceding claims in which an air vent pipe is provided to enable substantially all the air within the vessel to be expelled upon filling it with liquid, said pipe being flexible and arranged to stow behind the rigid protective shield, when the vessel is in its collapsed condition, so as not to be borne on by any spacing or load bearing member.

15. A cargo container constructed, arranged and adapted for use and operation substantially as shown in and herein described with reference to the accompanying drawings.

16. A cargo container substantially as herein described with reference to the accompanying drawings.

17. A land-, water- or air-borne vehicle including a cargo-container according to any one of the preceding claims.

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