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**B65D 90/04**

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**E1T 5D2 7CX**

(56) Documents cited

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<b>GB A 2021184</b>	<b>GB 1472178</b>	<b>GB 1285785</b>
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(58) Field of search  
**E1T**  
**B8D**

(54) **Tank lining**

(57) A tank has a water/air tight flexible lining (4) secured by diaphragm flanged connections (9) and (10) to a central fill/empty tube (5) and still bottle (6). It is fitted between a base locating collar (1) and a top deck fitting. The complete assembly is installed inside an existing storage container, to provide a totally separate and contaminate free storage system with the ability to use both the existing storage system and the new lining for different products, individually, or both at the same time. After the product has been removed from the lining, it collapses around the fill/empty tube, enabling the existing storage to be used for its primary function with only a small reduction in capacity.

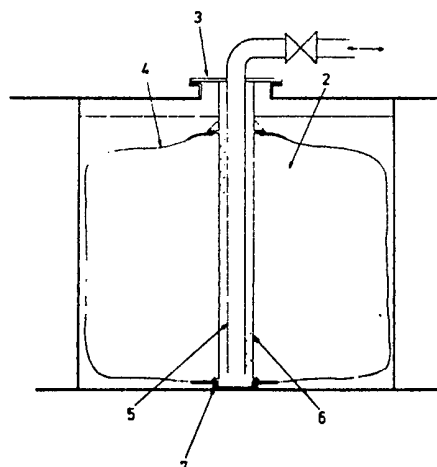


FIGURE 1

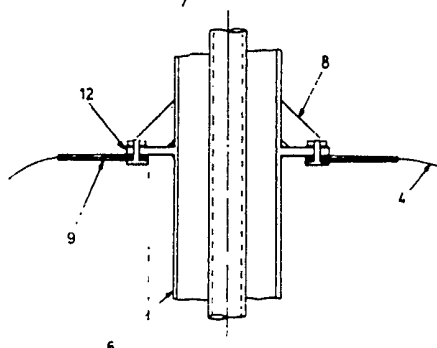
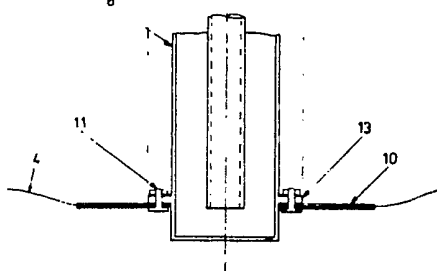


FIGURE 2



UDC 621.403.33.01

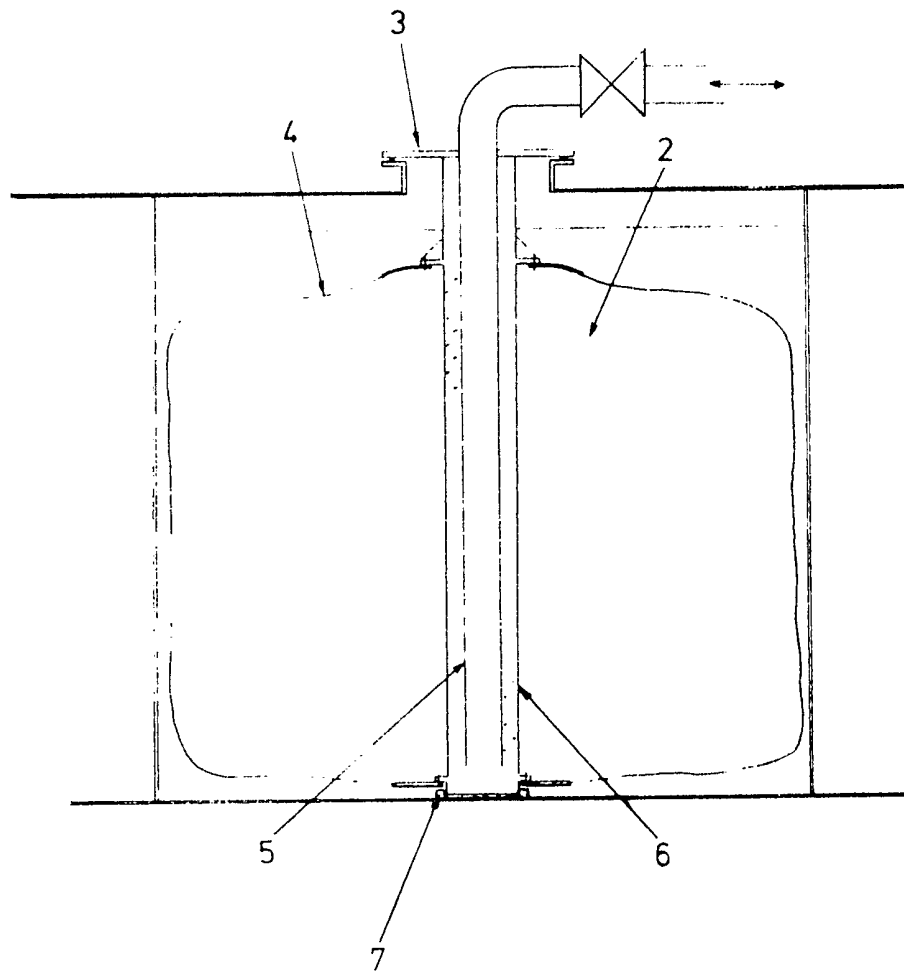


FIGURE 1

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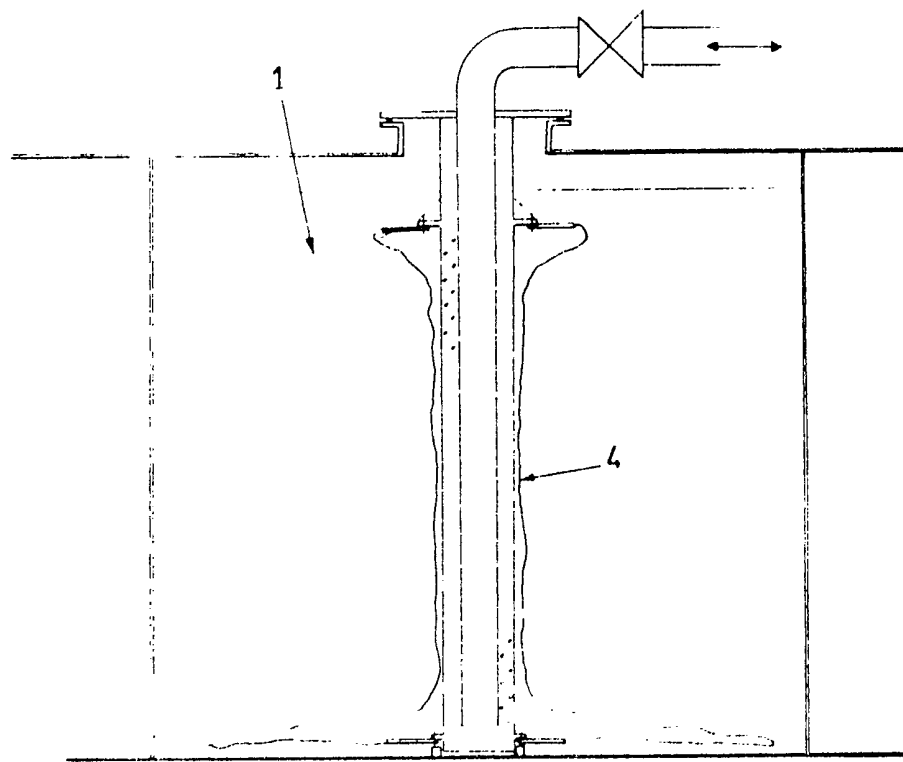


FIGURE 2

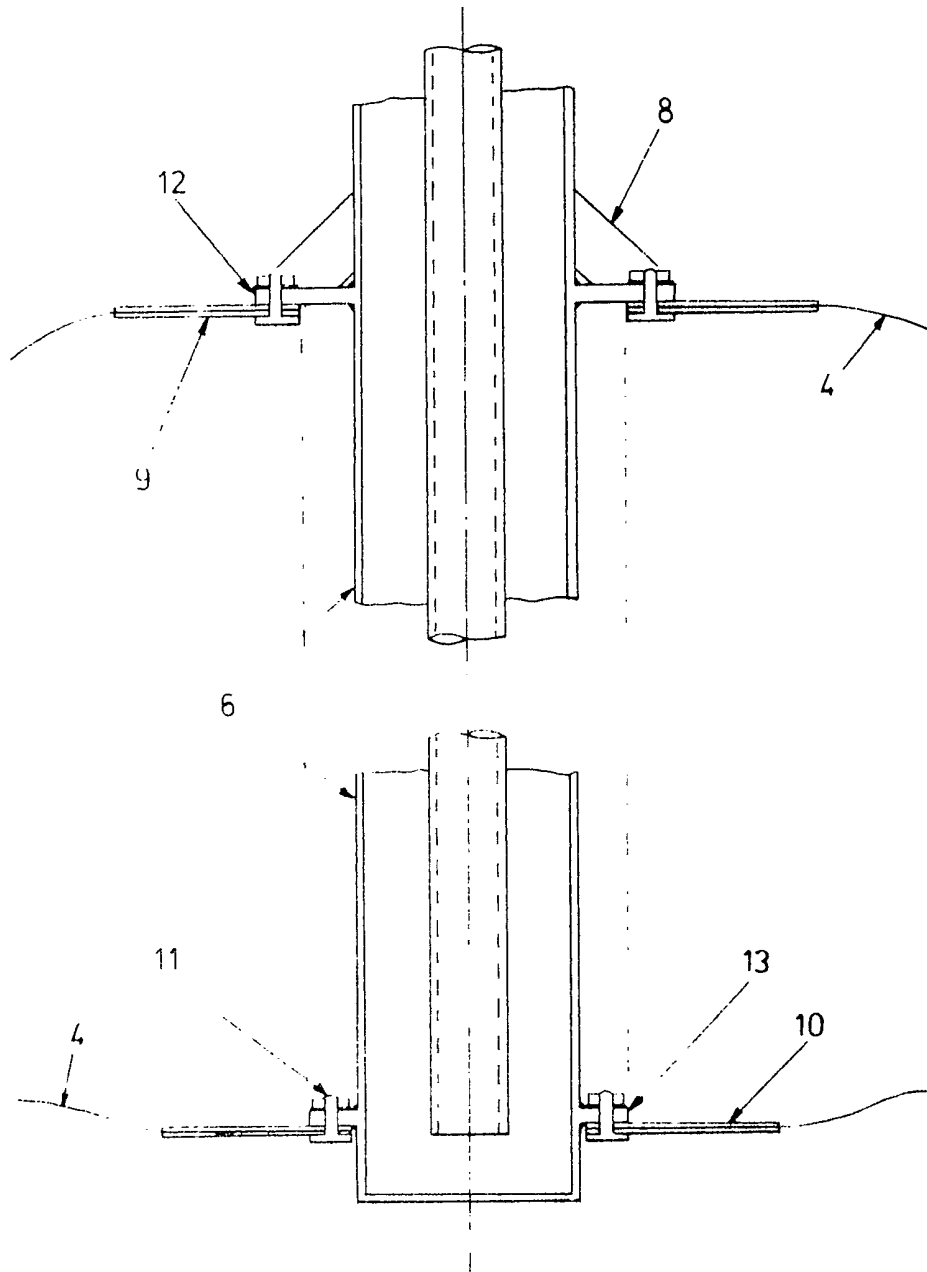


FIGURE 3

## SPECIFICATION

### Flexible multi-product storage facility

5 This invention relates to a flexible pure product storage container system.

It has long been a problem that storage facilities have been capable of holding one product only (unless expensive cleaning procedures are carried out) due to contamination, making them inflexible to multi-product storage. The ability to use temporarily or permanently redundant contaminated storage space would effectively reduce the cost of operating a given process area by reducing the need for capital expenditure on new storage facilities. Especially if the new storage is only of a temporary nature.

A typical illustrated of how this system could be used in a marine application is as follows:

An oil tanker leaves a Middle-Eastern oil terminal for the U.K. loaded with crude oil. On discharging, the vessel returns to the Middle-East empty. The cost of both trips reducing the profitability of the cargo. The tanks are always contaminated by oil and so are unfit for the storage of any other commodity. By installing this new system, the tanks can be used to transport a cargo on the return leg, discharging either en route or at the destination.

An example of how the system could be used in a land-based application is as follows:

A chemical company has a tank farm storage system and, due to changing requirements and methods of production, are faced with the expense of cleaning and decontaminating the existing storage tanks or the demolition and rebuilding of new ones. The new system enables the company to use the existing facility without doing either, with greatly reduced costs and an increase in flexibility.

For all applications, the new system essentially requires a flexible water/air tight lining supported by a central fill/empty tube. These are the basic features of the invention. The installation of this facility while slightly reducing the capacity of the existing tank does not preclude its use in its primary capacity. The flexible lining would collapse around the central fill/empty tube making way for the stored product.

To relate this back to the marine application, after the tanker has discharged its crude oil in the U.K., the flexible internal storage could be filled with another cargo to be discharged on the return leg. On arrival at the oil export terminal, the lining will be in a collapsed state and the tanks will be ready to resume their primary function without any need to stow away the lining.

In order to minimise the danger of lining perforation, when the lining is filled, it is essential that the lining be surrounded within

the tank by a cushion of liquid (sea water in the case of an oil tanker) to support and protect against the motion of the lining against sharp objects. These would be sharp objects that could not be removed prior to the installation of the lining. This cushion may not be required when used in a static land-based tank with a projection free internal surface.

Single tanks can be converted to handle multiple storage linings from either individual fill/empty tubes or a complex single tube.

Although the system will not remedy structural problems in a storage facility, it can be used to utilise a leaking tank, providing a supporting cushion of liquid is not required.

*Figure 1* shows a general arrangement of the system with the new storage area 2 in use. The fill/empty tube 5 and the still bottle 6 are both welded to the top flange which is part of the new deck fitting 3. The bottom of the still bottle 6 fits into the locating collar 7 which is fixed to the bottom of the existing tank. The flexible lining 4 is sealed to the still bottle 6 by means of a diaphragm, studs and flanges which are detailed in Fig. 3.

*Figure 2* shows a general arrangement of the system with the existing storage area 1 in use. The flexible lining 4 is seen in a collapsed state.

*Figure 3* is a detail of the top and bottom flanges for fixing the flexible lining 4 to the still bottle 6. The diaphragms 9 and 10 are two layers of thicker material which sandwich the thinner flexible lining 4. The studs 11 are fixed to a backing flange and bolted through the diaphragms 9 and 10 and through the fixed flanges 12 and 13. The outside diameter of lower flange 13 is smaller than the inside diameter of diaphragm 9 allowing them to pass each other during installation. The top flange is strengthened by stiffeners 8.

### CLAIMS

1. A flexible pure product storage facility (hereafter known as FPPSF) consisting of a water/air tight lining adapted to fit inside existing storage areas, with an integral central fill/empty tube for the conveying of products with a central support tube in a locating collar at the base and a sealed top entry position.

2. FPPSF as claimed in 1 wherein the flexible lining is incorporated and is sealed to the central support tube.

3. FPPSF as claimed in 1 and 2 wherein the central supporting tube is fixed to the base and the top of the existing storage facility and perforated over the length inside the lining.

4. FPPSF as claimed in 1 and 3. A fill/empty tube which is sealed inside the central supporting tube extending from the top to the bottom of the tube.

5. FPPSF as claimed in 1 and 3. A locating collar positioned at the base of the fill/empty tube fixed to the existing structure.

6. FPPSF as claimed in 2. Diaphragm support/sealing unit.
7. FPPSF as claimed in 1 and 5. A sealed top entry position will, when located seal the storage area and hold the central supporting tube in the locating ring.
8. FPPSF substantially as indicated in Figs. 1, 2, & 3.

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