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(54) Transportable liquid dispensing system

(57) The invention relates to a transportable system (1, Figs 1 and 2) for dispensing liquids such as water, petrol, diesel or aviation fuel. The system includes a liquid storage tank 2 supported inside a rectangular support frame 3. The tank 2 is mounted to the support frame 3 by a plurality of resilient support means 12. Each support means 12 comprises a resilient pad 16 made of neoprene placed between the tank and support frame and three pairs of springs 17 held in compression which urge the tank and frame towards each other, compressing the pad. The support frame 3 is adapted for detachable engagement with a land vehicle, and may also be carried by helicopter or transport plane. The frame 3 is ISO compatible and is also provided on one end with a bale bar mounted in an A-frame so as to be DROPS compatible. The system is also configured to allow one frame 3 to be stacked on top of another. The system includes a self-contained and fully interchangeable pumping module (20) mounted within the frame 3 for the delivery of the liquid in the tank.

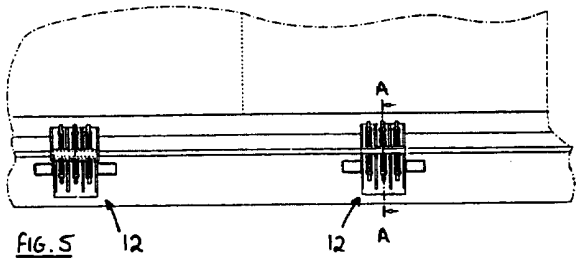

FIG. 5

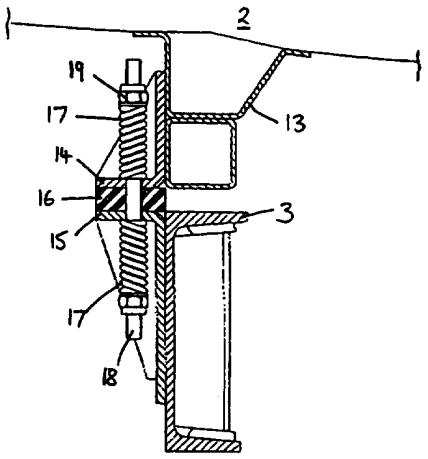

FIG. 6

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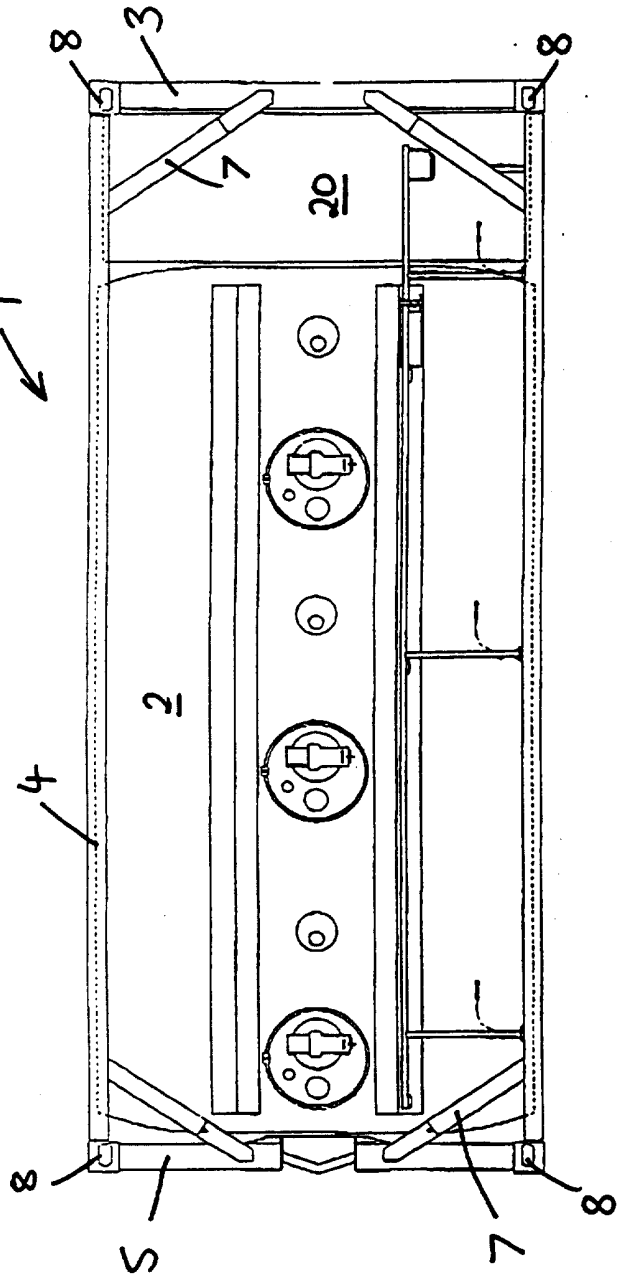

FIG. 1

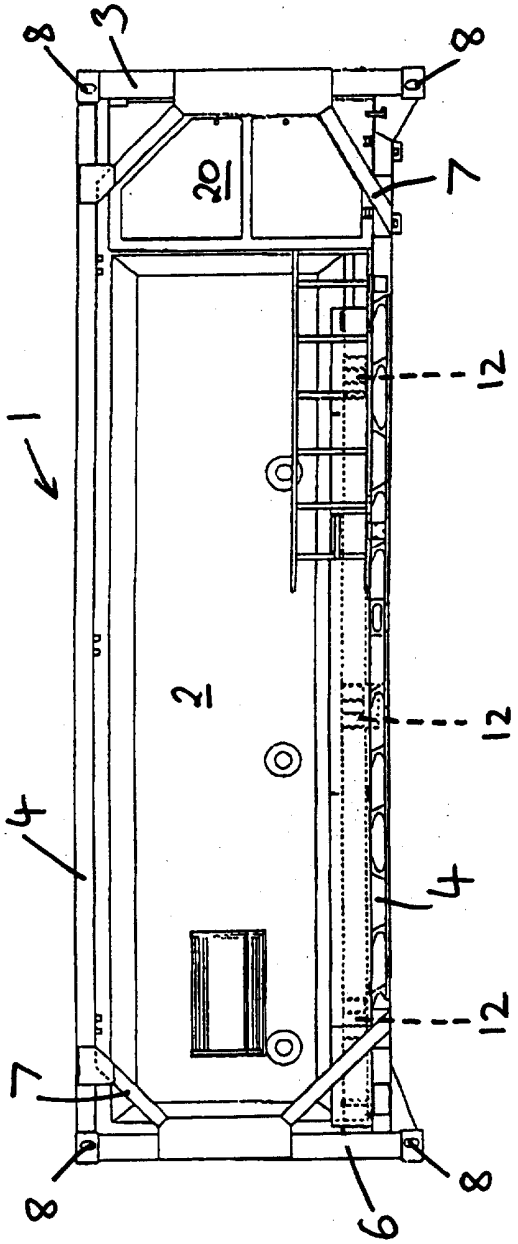

FIG. 2

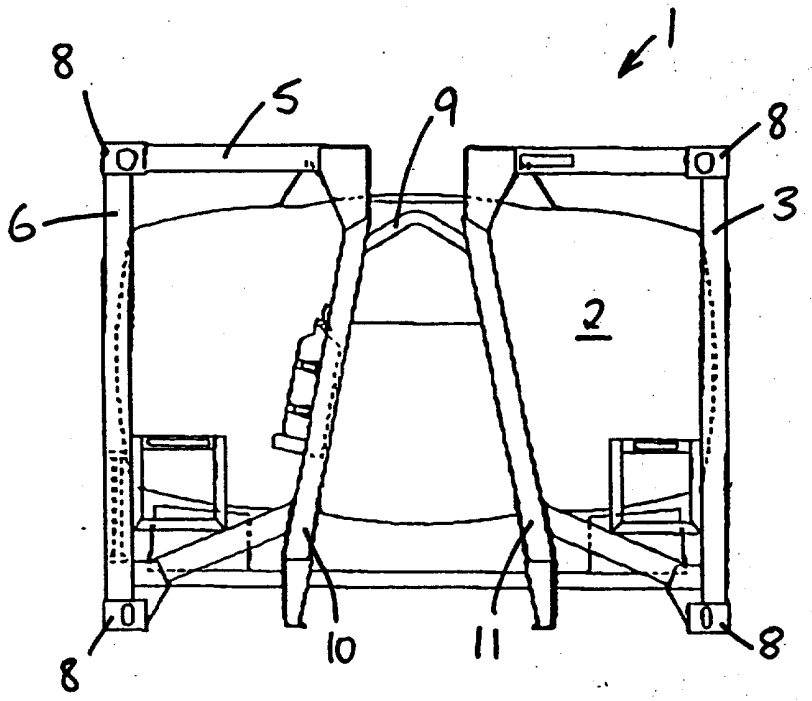

FIG. 3

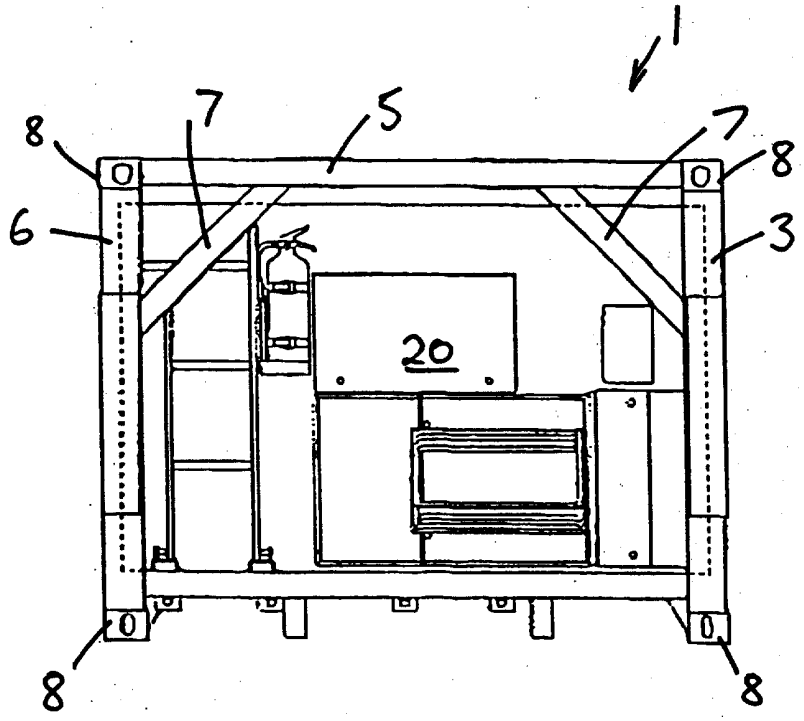

FIG. 4

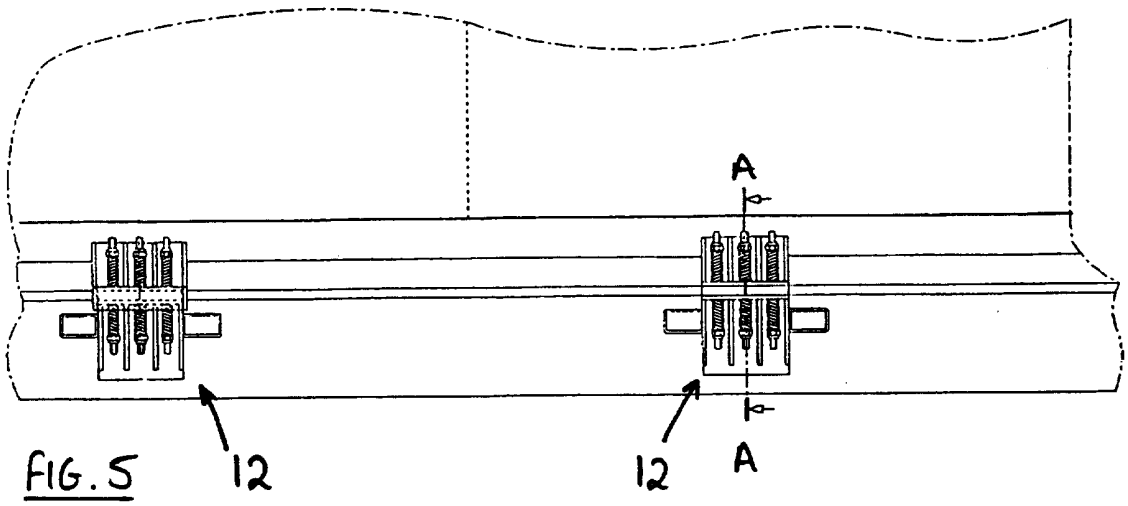

FIG. 5

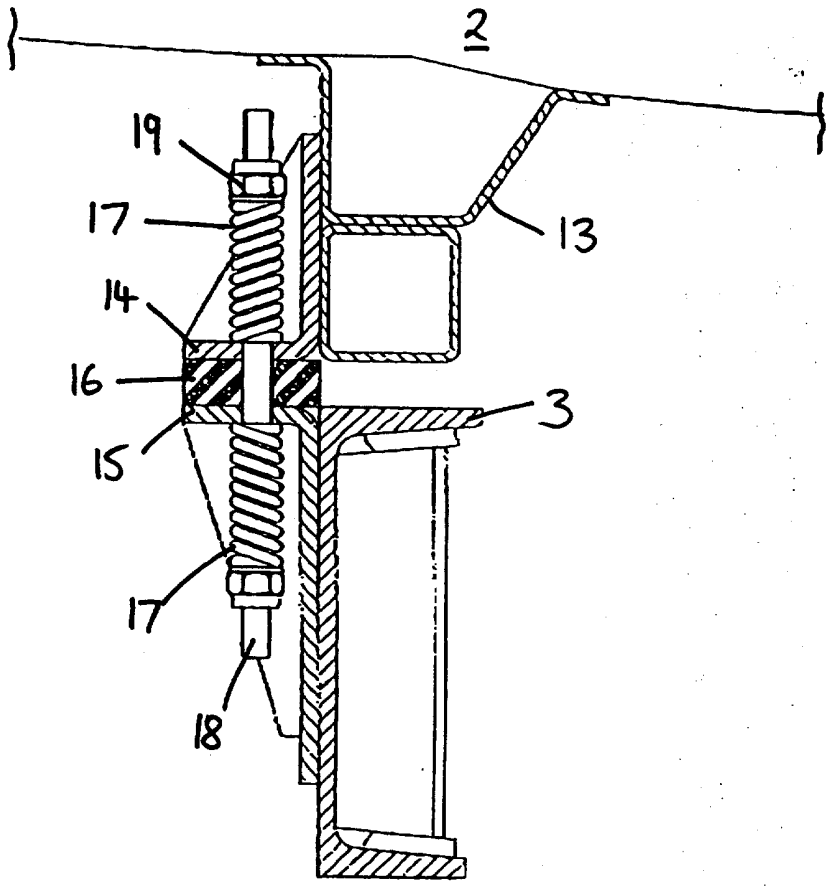

FIG. 6

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Transportable Liquid Dispensing System

The present invention relates to a transportable liquid dispensing system. Such a system is suitable for dispensing any liquid including, for example, water or fuels such as petrol, diesel or aviation fuel. Such a system may be used in remote areas, where traditional fuel and water supplies are not available.

The transportation of liquids by road or rail is commonplace. Liquids are traditionally transported in tankers in which a tank is permanently fixed to a vehicle or vehicle chassis, such as either a goods vehicle trailer for road transport or a goods waggon chassis for railway transport. The disadvantage with such tankers is that they are expensive to manufacture because a chassis must also be made for each tank. Further, such tankers cannot be readily transported by air, nor can they efficiently be transported by sea. They have inherent disadvantages if intended to be left in a remote position for an extended period for use e.g. as a temporary fuel station or water supply system since the attached vehicle or chassis is immobile during this time and cannot be used for other tasks.

Tankers have also been developed for compatibility with container systems (commonly referred to as ISO container handling systems) for transportation by road, rail and sea. The tank is fixed within a framework which is compatible with the handling equipment and vehicle mountings, and consequently tankers of this type do not have the disadvantage of being permanently fixed to a vehicle chassis. However, such ISO tankers are not designed to be left in remote places where they can be used to dispense their liquid because they do not have self-contained dispensing or pumping systems. They are solely transport systems and have not been proposed for use as transportable liquid supply systems.

Another problem with both types of tankers discussed above is that the tank is rigidly mounted (usually welded) to the chassis or frame carrying it. This exposes the tank to high levels of mechanical shock, vibration and torsional forces, which can be particularly high in remote areas where the quality of the roads or railway lines is worse. The tank is at risk of rupturing, which can be expensive both in terms of damage to the tank and also loss of the liquid. This can also be very hazardous if the load is an inflammable fuel such as petrol.

According to the invention, there is provided a self-contained transportable liquid dispensing system comprising a liquid storage tank, means for pumping liquid from the tank, and a support frame surrounding the tank, wherein the tank is mounted to the support frame by a plurality of resilient support means and the support frame is adapted for detachable engagement with a land vehicle.

Thus, the invention provides a system which can be left at a remote location whilst its liquid is being dispensed. A land vehicle used to transport the system need not be inactive whilst the system is at its operational location. Further, the system may be detached from the vehicle for more efficient transport by rail, sea or air. There are also significant manufacturing cost benefits since a separate vehicle/chassis need not be provided for each dispensing system. By means of the resilient support means, mechanical shock and vibration to the tank itself is reduced. This adapts the system for transportation to remote areas for use as a temporary fuel station or water supply station.

Preferably, the support frame is prestressed to improve resistance to vibration and torsional effects.

Each resilient support means preferably includes a resilient pad mounted between the tank and the support

frame. The pad is preferably made from a rubber, such as neoprene. The pad preferably has a shore durometer hardness of between 70 and 90, and more preferably 80. Also, the pad is preferably between 20 and 30 mm thick, and more preferably 25 mm thick. However, any suitable combination of hardness and thickness which achieves the desired reduction of transmission of vibration from the support frame to the tank is envisaged.

Each resilient support means preferably further includes at least one spring means which is configured to urge the tank and the support frame towards each other via the resilient pads. This provides some degree of attachment between the tank and the support frame, but allows restricted vertical and horizontal relative movement. The spring means also helps to prevent the tank from leaving engagement with the pad and creating a shock on its return into engagement. Preferably, each spring means comprises a pair of springs which are located on each side of the resilient pad.

The particularly preferred structure of support means comprises a pair of rigid support flanges fixedly mounted respectively to the support frame and to the tank, and arranged in face to face relation with the resilient pad or pads located therebetween. A retaining member extends through the flanges and pad, and mounts on either side of each flange a compression spring, such springs cooperating with each flange and with the retaining member to resiliently urge the flanges towards one another against the pad.

The preferred support system of the present invention allows a degree of movement of the tank relative to the support frame both in the vertical and horizontal directions, thereby minimising torsional loads in transit from the vehicle onto the tank.

The support frame preferably consists of a three-dimensional rectangular structure surrounding the tank. The system may be adapted to be carried by ISO vehicles

and handling equipment, and therefore the support frame can have ISO corners at each corner thereof. Preferably also, the support frame is of a suitable length and width to be ISO compatible.

Preferably, the system is configured to be stackable. Thus, in a preferred embodiment, the support frame is adapted to support the support frame of at least one like dispensing system stacked thereon.

Preferably, either in addition to its ISO compatibility or as an alternative, the system is adapted to be handled by DROPS vehicles. DROPS (Demountable Rack Offloading Palletised System) vehicles have a vertically extending arm with a hook on the end thereof which engages a bale bar fixed to the load. The arm is able to move relative to the vehicle along the load platform, and the platform is also able to tilt. In this way, the hook can be brought into engagement with the bale bar of a load which is resting on the ground, and the load can then be pulled onto the vehicle. Therefore, the support frame of the present invention preferably includes a bale bar mounted at one end thereof. This may form part of an "A" frame section at one end of the frame.

It is also envisaged that the system can be carried by a helicopter as an underslung load, or carried in a transport plane. The frame is therefore preferably sufficiently self-supporting for this purpose, and preferably includes means for attaching to airborne supporting cables.

Optionally, the tank may be divided into a plurality of compartments for the separate storage of different liquids. Also, the tank may be provided with a plurality of baffles therein which restrict the flow of the liquid(s) inside the tank during transportation. These help reduce a sudden surge of liquid to one end of the tank, with consequential handling problems.

The pumping means preferably comprises a pump and

one or more hoses for delivery of the or each liquid in the tank via dispensing lines communicating with the tank. Conventional nozzles may be provided on the end of each hose. Preferably, the pump is able to operate without the need to be connected to an external power source, and may, for example, run on diesel. The pumping means is also preferably adapted to fill the tank(s) in addition to dispensing the liquid therefrom. In this way it is possible to redistribute liquid in the tank from one compartment to another. The dispensing lines between the tank and the pumping means are preferably flexibly mounted to allow resistance to shock and vibration. Preferably, the pumping means is an interchangeable module which can be removed from the dispensing system for repair or replacement with a similar or a differently-configured pumping means.

Preferably, the dispensing system additionally comprises one or more filtration means either up- or down-stream of the pump. This may form part of the pumping means, or can be separate. In this way, not only can the liquid be filtered before being dispensed, but also the dispensing system can filter liquids in a self-contained manner by transferring liquid from one compartment to another via the filtration means.

If the pump is not functioning or is not required, it is envisaged that the dispensing system will work equally well as a gravity-feed system.

The invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Fig. 1 is a top view of the liquid dispensing system of the present invention;

Fig. 2 is a side view of the liquid dispensing system of the present invention;

Fig. 3 is a view of the front end of the dispensing system;

Fig. 4 is a view of the rear end of the dispensing

system;

Fig. 5 shows the configuration of the resilient support means according to a preferred embodiment; and

Fig. 6 shows the resilient support arrangement in partial cross-section along line A-A of Fig. 5.

With reference to Figures 1 to 4, liquid dispensing system 1 comprises a tank 2 supported inside a rectangular support frame 3.

The tank 2 is a fully welded metal box-shaped tank, which is designed to keep its centre of gravity as low as possible. Preferably, the tank is made from stainless steel. It can hold up to a total of 12000 litres of liquid in three separate compartments. The tank has the following operational features:

a) bottom and top fill capability;

b) automatic overfill sensing and shut-off;

c) contaminant sump, together with drain valves;

d) liquid sampling valves;

e) automatic pressure relief systems, with appropriate safety flame traps;

f) flame proof dip tubes and dipsticks;

g) lateral and longitudinal baffles to improve vehicle handling; and

h) fully enclosed overspill valance welded at the top of the tank, together with drain hoses and valves to allow controlled removal of any overspill.

The frame 3 is constructed from welded steel members such as longitudinal, lateral and vertical members 4, 5 and 6. Further strengthening is provided by corner reinforcing members 7. ISO corners 8 are provided at each upper and lower corner of the frame 3. In this embodiment, the frame has a length of 6058mm and a width of 2438mm to achieve ISO compatibility.

The frame is pre-stressed during construction to improve resistance to vibration and torsional effects. The frame provides side protection for the tank as

required when transporting dangerous goods by road, and also provides full roll-over protection.

As shown in Figure 3, the frame also has a bale bar 9 mounted in an A-frame formed by members 10 and 11 to allow handling, unloading and loading by DROPS compatible equipment, as discussed above.

The design of the frame allows the dispensing system to be lifted by the top or bottom of the frame for general transportation and handling, and also carriage of the system as an underslung load by helicopter. The frame also allows vertical stacking of two or more similar systems such as, for example, three high for storage and two high for shipboard transportation. Twistlock stacking adaptors can be used to secure the stacked systems together.

With reference to Figures 2, 5 and 6, the tank 2 is mounted on the frame 3 by means of six resilient support means 12. Three support means 12 are on each side of the tank, one each at the front, centre and rear of the tank.

A cross-section of one support means 12 is shown in Figure 6. Support rail 13 is fixed on the underside of the tank 2. Tank flange 14 is mounted to the support rail 13. Support frame flange 15 is mounted to support frame 3. Each resilient support means consists of a 2.5 cm thick neoprene pad 16 having a shore durometer hardness of 80, which is placed between tank flange 14 and the support frame flange 15, such that the weight of the tank compresses the pad 16 between the flanges.

In order to provide some degree of attachment between the tank 2 and the support frame 3, but to allow restricted vertical and horizontal relative movement therebetween, three pairs of springs 17 are provided. These springs are held in compression on mounting studs 18 by means of nuts 19, which urge the tank flange 14 and the support frame flange 15 towards each other, thereby compressing the pad. This arrangement is

configured to allow approximately 50 mm relative vertical movement between the tank and the support frame to minimise the transmission of torsional loads from the vehicle to the tank.

With reference to Figures 1, 2 and 4, the pumping system and ancillaries are housed within a self-contained and fully interchangeable pumping module 20 mounted within the frame 3 at the rear of the tank. Module 20 contains a diesel engine, clutch, gearbox, pump and filtration system, together with ancillary pipes and valves (not shown in the drawings). The module also contains hose reels and nozzles, together with a range of outlets to allow worldwide commonality, for providing the required configuration of dispensing outlet. Earth bonding wires and connections are also provided. The pipework is flexibly mounted to allow shock and vibration resistance. Full access to all components in the module is provided allowing simplicity and ease of maintenance.

The diesel engine is mounted in a separate compartment within the pumping module 20. It has electrical and manual start capabilities, and will start and operate at low ambient temperatures such as -31°C. The engine is manufactured to be intrinsically safe for operation in an explosive environment with intrinsically safe electrical components, automatic over-run protection and intake flame trap. The exhaust gas temperature and engine surface temperatures are maintained within safely low levels by using appropriate cooling air flow and thermal design techniques.

The pumping module operation can be configured by the actuation of valves. The following operations are possible:

a) gravity discharge;

b) pumped discharge at rates of up to 880 litres/minute;

c) self-filling using the pumping system at rates

of up to 880 litres/minute;

d) filling from an externally-pumped source, at rates of up to 1350 litres/minute;

e) pumped recirculation of liquids to allow redistribution of load or liquid filtration; and

f) self-priming of the pumping system.

When being used for dispensing fuel, for example, the system will allow the safe filling of up to four vehicles at distances of up to 18 metres from the tank.

Space underneath the tank can be used for additional stowage of hoses and ancillary equipment.

The liquid dispensing system of the preferred embodiment is a highly mobile rugged complete liquid supply system capable of full cross-country performance, and capable of withstanding the loads imposed by emergency conditions experienced in air carriage. It is capable of safe operation, transportation and storage over the temperature range of -31°C to +49°C.

Claims:

1. A self-contained transportable liquid dispensing system comprising a liquid storage tank, means for pumping liquid from the tank, and a support frame surrounding the tank, wherein the tank is mounted to the support frame by a plurality of resilient support means and the support frame is adapted for detachable engagement with a land vehicle.

2. The liquid dispensing system according to claim 1, wherein the support frame is prestressed.

3. The liquid dispensing system according to claim 1 or 2, wherein each resilient support means includes a resilient pad mounted between the tank and the support frame.

4. The liquid dispensing system according to claim 3, wherein the pad is made from a rubber.

5. The liquid dispensing system according to claim 4, wherein the pad is made from neoprene.

6. The liquid dispensing system according to claim 3, 4 or 5, wherein the pad has a shore durometer hardness of between 70 and 90.

7. The liquid dispensing system according to any of claims 3 to 6, wherein the pad has a shore durometer hardness of 80.

8. The liquid dispensing system according to any of claims 3 to 7, wherein the pad is between 20 and 30 mm thick.

9. The liquid dispensing system according to any of

claims 3 to 8, wherein each resilient support means further includes at least one spring means which is configured to urge the tank and the support frame towards each other.

10. The liquid dispensing system according to claim 9, wherein each spring means comprises a pair of springs which are located on either side of the resilient pad.

11. The liquid dispensing system according to any of claims 3 to 10, wherein each resilient support means further includes a pair of rigid support flanges fixedly mounted respectively to the support frame and to the tank and arranged in face to face relation with the resilient pad located therebetween.

12. The liquid dispensing system according to claim 11, wherein a retaining member extends through the flanges and pad, and mounts on either side of each flange a compression spring, such springs cooperating with each flange and with the retaining member to resiliently urge the flanges towards one another against the pad.

13. The liquid dispensing system according to any preceding claim, wherein the support frame consists of a three-dimensional rectangular structure surrounding the tank.

14. The liquid dispensing system according to any preceding claim, wherein the support frame is ISO compatible.

15. The liquid dispensing system according to any preceding claim, wherein the support frame is adapted to support the support frame of at least one like dispensing system stacked thereon.

16. The liquid dispensing system according to any preceding claim, wherein the system is adapted to be handled by DROPS vehicles.

17. The liquid dispensing system according to claim 16, wherein the support frame includes a bale bar at one end thereof.

18. The liquid dispensing system according to any preceding claim, wherein the frame includes means for attachment to airborne supporting cables.

19. The liquid dispensing system according to any preceding claim, wherein the tank is divided into a plurality of compartments for the separate storage of different liquids.

20. The liquid dispensing system according to any preceding claim, wherein the tank is provided with a plurality of baffles therein which restrict the flow of the or each liquid inside the tank during transportation.

21. The liquid dispensing system according to any preceding claim, wherein the pumping means comprises a pump and one or more hoses for delivery of the or each liquid in the tank via dispensing lines communicating with the tank.

22. The liquid dispensing system according to claim 21, wherein the dispensing lines between the tank and the pumping means are flexibly mounted.

23. The liquid dispensing system according to any preceding claim, wherein the pumping means is adapted to fill the or each tank in addition to dispensing the liquid therefrom.

24. The liquid dispensing system according to any preceding claim, wherein the pumping means is an interchangeable module which can be removed from the dispensing system.

25. The liquid dispensing system according to any preceding claim, wherein the dispensing system additionally comprises one or more filtration means.

26. A liquid dispensing system substantially as hereinbefore described with reference to the accompanying drawings.

The Patent Office

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Application No: GB 9607005.7 **Examiner:** Dave McMunn
Claims searched: 1-26 **Date of search:** 9 June 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B8P (PK7)

Int Cl (Ed.6): B65D 88/12

Other: -

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2,073,146 A	(GRAAFF). Note buffers 24, 25 & suspension 29	1,2,13-15, 18,21,23,
X	EP 0,031,775 A1	(CONTAINNEERING). Note 16	1-8,11,13-15, 18,21,23
X	US 4,354,612	(PELABON). Note 20	1-8,11,13-15, 18,21,23

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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