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(71) Applicant: **SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.**
Carel van Bylandtlaan 30
NL-2596 HR Den Haag(NL)

(72) Inventor: **Kilner, David Nicholas**
Dragons Farm,
Dragons Green
Horsham, West Sussex RH13 8PD(GB)

(54) Vented vessel.

(57) An unpressurised vessel (1a) comprises a tank (1b) and has a safety vent which prevents spillage of hot or dangerous liquids from inside the tank (1b) on a change in attitude of the vessel (1a), for instance following an accident involving a vehicle carrying the vessel (1a). The safety vent comprises a duct (5) forming a continuous channel from an outlet (3) from the tank (1b) above the surface of the liquid into a first duct end (6) preferably located near to a first tank end (2) and extends around the tank (1b), describing the extremities of the tank (1b) to a second duct end (7) which is open to the atmosphere.

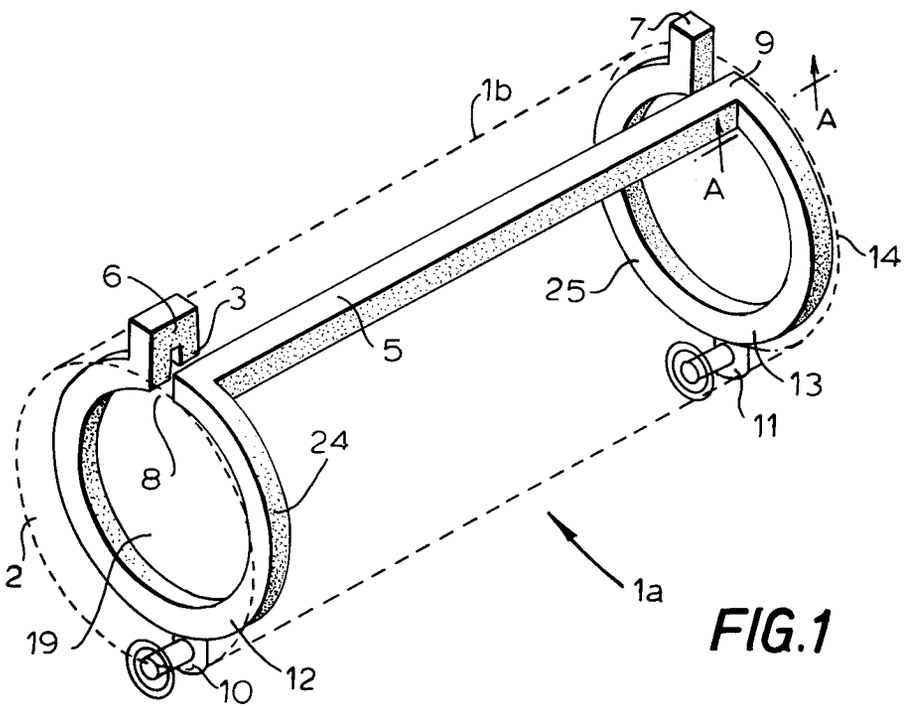

FIG.1

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The present invention relates to an unpressurised vessel for containing liquids which comprises a safety vent which allows venting to the atmosphere in such a way that, should the attitude of the vessel change, for instance following an accident involving a vehicle carrying the vessel, then the contents will be retained within the vessel with the minimum of loss. The invention is of particular use for transporting hot and/or dangerous liquids such as road dressing materials.

Solutions exist for pressurised tankers which can be sealed with pressure relief valves and other devices. However such venting or sealing systems are impractical for non-pressurised tanks. Furthermore the provision of such valves for some types of vessels could be dangerous if pressure builds up inside the tank without being able to vent to atmosphere.

US Patent No. 4,492,244 discloses a non-spill liquid fuel tank with a filler and a non-return vent arranged to vent the tank when in a generally upright attitude, comprising a fuel outlet duct extending to circuit the base of the tank, a first outlet duct vent having access to the outlet duct and extending to terminate at a position symmetrically disposed across the base of the tank to the access above the highest portion of the tank when in an upright attitude and a second outlet duct vent having access to the outlet duct beneath the position at which the first vent terminates and extending to terminate over the position at which the first vent has access to the outlet duct above the highest portion of the tank when in an upright attitude (Column 1, lines 41 to 54).

The fuel tank is vented by means of a non-return vent consisting of a valve which allows air to enter the fuel tank to compensate for outflow of fuel through the fuel outlet duct, without allowing fuel to pass in the opposite direction (Column 3, lines 15 to 19).

Furthermore, the fuel outlet duct and associated vents are arranged so that fuel is displaced from the fuel outlet duct by air drawn into the fuel outlet duct from the outlet duct vents when the tank is tilted from a generally upright attitude, thus preventing the unwanted escape of fuel from the fuel outlet duct (see Column 6, lines 8 to 13).

The non-spill tank described in US Patent No. 4,492,244 would be entirely unsuitable for transporting hot and/or dangerous liquids such as road dressing materials, as pressure build-up in the tank, being unable to vent to the atmosphere through the non-return vent, would act on the liquid contained in the tank causing it to be expelled from the outlet duct vents and to spill onto the roadway.

Attempts have been made using various designs of automatic self-sealing valves, but they are not suitable for vessels containing some materials, particularly materials of high viscosity or materials of a thermoplastic nature, which would prevent any "mechanical" valve from working efficiently, and could render it inoperative.

The present invention seeks to provide a simple safety vent which overcomes the above problems.

According to the present invention there is provided an unpressurised vessel for containing liquids comprising a tank having tank walls defining an internal space and having a safety vent which comprises a continuous duct having first and second ends, in which an orifice defines an outlet from the internal space, positioned towards the top of the internal space when the vessel is in its normal use orientation, and leads into the first end of the duct, and in which the duct extends around the tank tracing substantially the whole of the tank perimeter leading to the second duct end which is open to the atmosphere.

Although it may be possible for the second duct end to be in a horizontal plane lower than the first duct end at the outlet from the internal space, it is preferable that the second duct end should in approximately the same horizontal plane as the first duct end, that is whilst the vessel is in its normal use orientation.

Preferably the tank has first and second tank ends and the second duct end is located adjacent to the second tank end.

The outlet from the internal space may conveniently be located adjacent to the first tank end or at a position between the first and second tank ends.

In the preferred embodiment of the invention, adjacent the first duct end the duct forms an inverted U-shape. In order to prevent self-siphoning, an anti-siphoning device is provided inside the duct at the elbow of the U-shape section. Anti-siphoning devices are known and work by preventing any part of the channel inside the duct completely filling with liquid to the exclusion of all air, thereby preventing a condition under which siphoning could occur.

Preferably the lowermost part of the duct or of each of two or more portions of the duct, is furnished with a drainage valve. Should any liquid be ejected from internal space of the tank into the channel formed by the duct during normal operation, it can easily be removed via the drainage valves.

Since the invention is of particular value for vessels used to transport hot liquids, especially liquids which solidify at lower temperatures, in order that solidification within the channel formed by the duct, with consequent blocking of the channel, is prevented, preferably the duct is in heat conduction contact with the internal space, which is usu-

ally heated. The heat conduction contact allows transfer of heat from the internal space of the tank through the duct walls so that any liquid in the channel is kept hot. This may be by forming the duct so that it forms part of the internal surface confining the internal space. Effectively therefore the duct is provided (i.e. located or positioned) inside the walls of the tank, i.e. the duct is provided internally of the tank walls. Alternatively the heat conduction contact may be through the duct and the tank walls, that is where the duct is formed outside the tank walls, i.e. the duct is provided (i.e. located or positioned) externally of the tank walls. In the latter case, it is preferred that the walls of the tank and of the duct are made of metal e.g. steel. For minimising the likelihood of spillage it is preferred for the duct to be provided on the outside (externally) of the tank walls.

By providing a duct which extends around the tank tracing substantially the whole of the tank perimeter, this means that in any orientation of the vessel, for instance even after a change of attitude following an accident involving the vehicle carrying the vessel, there will be at least a portion of the channel which is above the level of liquid inside the tank. The invention is of particular use where the liquid contained in the tank is hot and/or dangerous. The liquids may therefore be a hydrocarbon fuel product or especially a road dressing material, for instance an emulsion or a liquid thermoplastic material.

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

Figure 1 illustrates a perspective view of a vessel embodying the present invention, in which the duct is located internally of the tank walls;

Figure 2 shows a partial section through the vessel of Figure 1 along line A-A;

Figure 3 illustrates a partial section through an alternative embodiment of the invention with the duct located externally of the tank walls; and

Figure 4 illustrates a perspective view of a further embodiment of the present invention, in which the outlet from the internal space is located at a position between the tank ends.

In the drawings, like integers are denoted by like reference numerals.

Figure 1 shows a vessel 1a comprising a circular cylindrical tank 1b (denoted by a broken line) having tank walls defining an internal space 19 and having a safety vent which comprises a continuous duct 5 having a first duct end 6 and a second duct end 7. The vessel 1a is shown in its normal use orientation, wherein the longitudinal axis of the tank 1b is in a substantially horizontal orientation. The tank 1b has a first tank end 2 and a second tank end 14. Adjacent the first tank end 2 and towards the top of the internal space 19 (i.e., at the uppermost part of the tank wall), there is located an orifice 3 defining an outlet from the internal space 19 which leads into the first end 6 of the duct 5 which forms a continuous channel between the first duct end 6 and the second duct end 7. Adjacent the first duct end 6, the duct 5 forms an inverted U-shape, inside which there is an anti-siphoning device (not shown) to prevent self-siphoning of liquid from the inside of the tank 1b. The duct 5 then passes in an anti-clockwise direction substantially all around the inner circumference of the tank 1b adjacent the first tank end 2 to the top point 8 adjacent the first tank end 2, from where it passes substantially horizontally inside the tank 1b to the top point 9 adjacent the second tank end 14, where it passes in a clockwise direction substantially all around the inner circumference of the tank 1b adjacent the second tank end 14 to the second duct end 7. The second duct end 7 is open to the atmosphere. The duct 5 thus extends around the tank 1b tracing substantially the whole of the tank perimeter.

As shown in Figure 1, it is preferred that the pathway for gas or vapour escape defined by a section 24 of the duct adjacent the first tank end extends in a different direction about the tank from that defined by a further section (25) of the duct adjacent the second tank end. In this way, a helical pathway for gas or vapour escape is avoided and thus there is less likelihood of spillage of liquid tank content if there is a change of orientation of the vessel, for example roll-over of the tank following an accident involving capsize of a vehicle carrying the vessel.

In order to remove liquid which collects inside the channel, drainage valves 10, 11 are located at the lowermost parts of the duct 5 adjacent the first 2 and second 14 tank ends.

Figure 2 shows a section through the tank 1b and the duct 5 of Figure 1 adjacent the second tank end 14. It can be seen that the duct 5 is formed of a substantially U-section strip of material 15, which is attached to the wall 4 of the tank 1b via the arms of the U 16, 17. The tank wall 4 and the U-section strip of material 15 are for instance formed of steel or other suitable metal. The duct 5 forms a channel 18. The duct 5 is in heat conducting contact with the internal space 19 within the tank 1b, heat being able to be conducted through the wall 15 of the duct 5.

In Figure 3 an alternative mode of construction of duct is illustrated. Here a substantially square section duct 20 is attached externally of the wall 4 of the tank, via a U-section retaining strip 21 provided with flanges 22 which can be attached to the tank wall 4 by welding, rivetting or other suitable means. The duct 20 forms a channel 18a. The duct

20 is in direct contact with the wall 4 of the tank along contacting surface 23. Heat conduction can take place between the duct 20 and the internal space 19a via the contacting surface 23.

Figure 4 shows a vessel 1c similar to that of Figure 1, except that the orifice 3 defining an outlet from the internal space 19 of the tank 1b is located towards the top of the internal space 19 at a position between and substantially equidistant from the first tank end 2 and the second tank end 14.

In the venting mode, under normal transport conditions, the tank is vented via the orifice 3 into U-section of the duct. Due to pressure any gas or vapour is forced around the channel within the duct around the end 2 of the tank, and along the continuous channel to the second end 7 of the duct, where it is vented to the atmosphere through the open end or via a flame-arresting device.

Claims

1. An unpressurised vessel for containing liquids comprising a tank having tank walls defining an internal space and having a safety vent which comprises a continuous duct having first and second ends, in which an orifice defines an outlet from the internal space, positioned towards the top of the internal space when the vessel is in its normal use orientation, and leads into the first end of the duct, and in which the duct extends around the tank tracing substantially the whole of the tank perimeter leading to the second duct end which is open to the atmosphere.

2. A vessel according to claim 1, in which the second duct end is in approximately the same horizontal plane as the first duct end when the vessel is in its normal use orientation.

3. A vessel according to claim 1 or claim 2, in which the tank has first and second tank ends and the second duct end is located adjacent to the second tank end.

4. A vessel according to claim 3, in which the outlet from the internal space is located adjacent to the first tank end or at a position between the first and second tank ends.

5. A vessel according to any one of the preceding claims, wherein a pathway for gas or vapour escape defined by a section of the duct adjacent the first tank end extends in a different direction about the tank from that defined by a further section of the duct adjacent the second tank end.

6. A vessel according to any one of the preceding claims, in which adjacent the first duct end the duct forms an inverted U-shape.

7. A vessel according to any one of the preceding claims, in which the duct is provided with a drainage valve at or adjacent the lowermost part of the duct.

8. A vessel according to any one of the preceding claims, in which the duct is in heat conduction with the internal space.

9. A vessel according to claim 8, in which the duct is provided externally of the tank walls.

10. A vessel according to claim 8, in which the duct is provided internally of the tank walls.

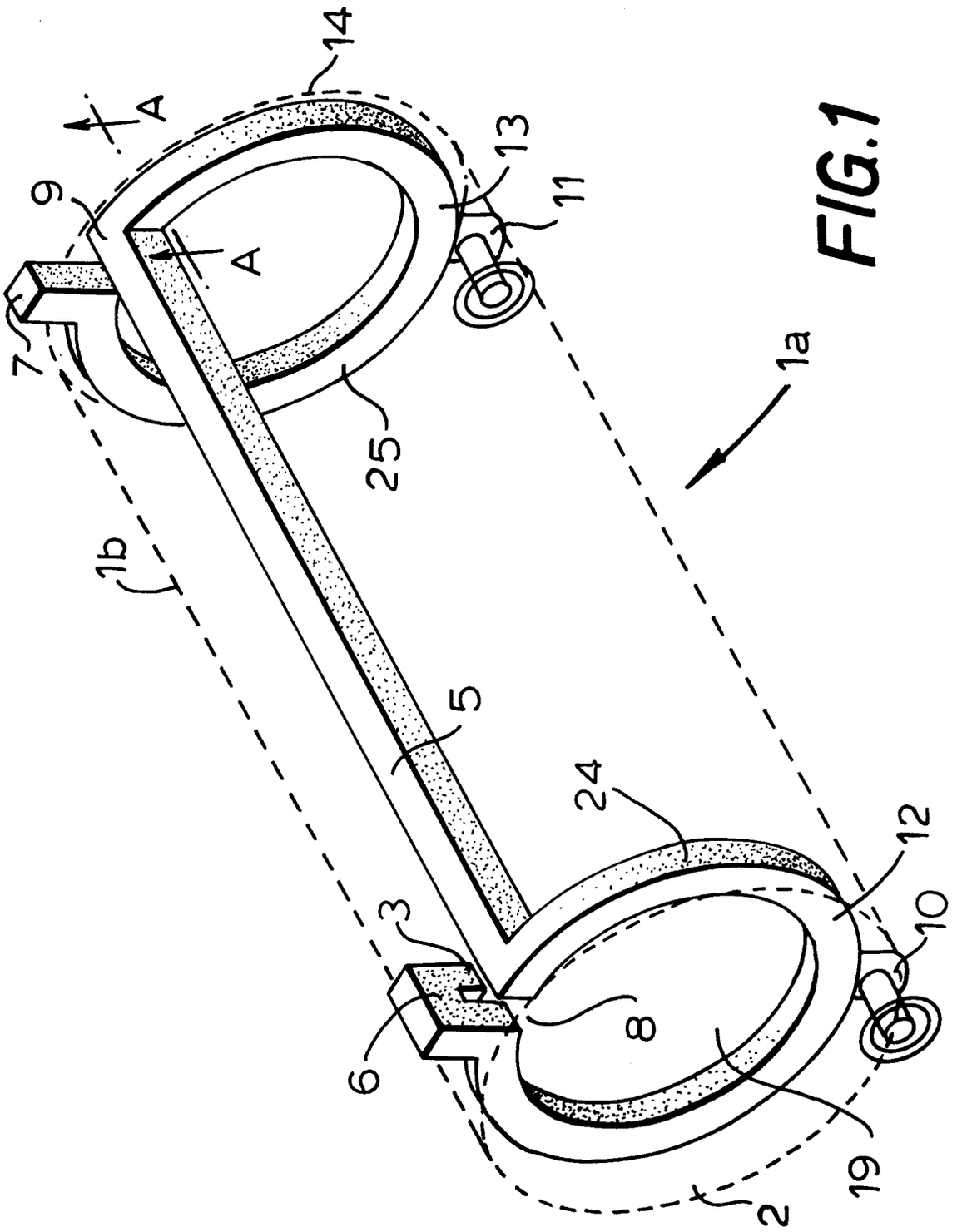


FIG.1

FIG. 2

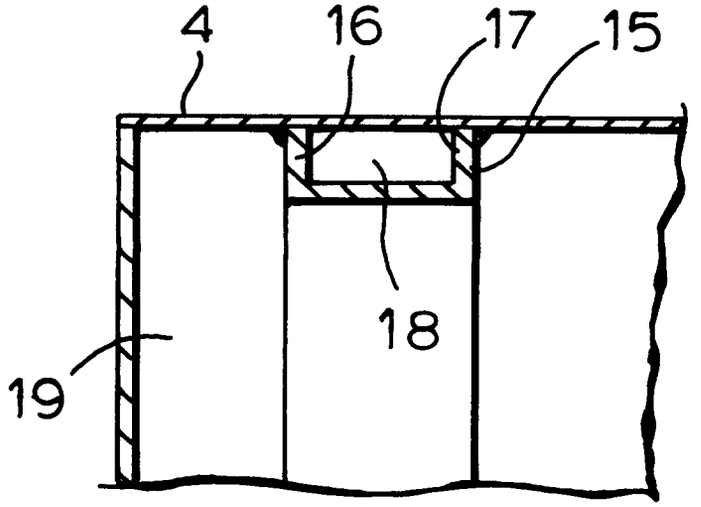
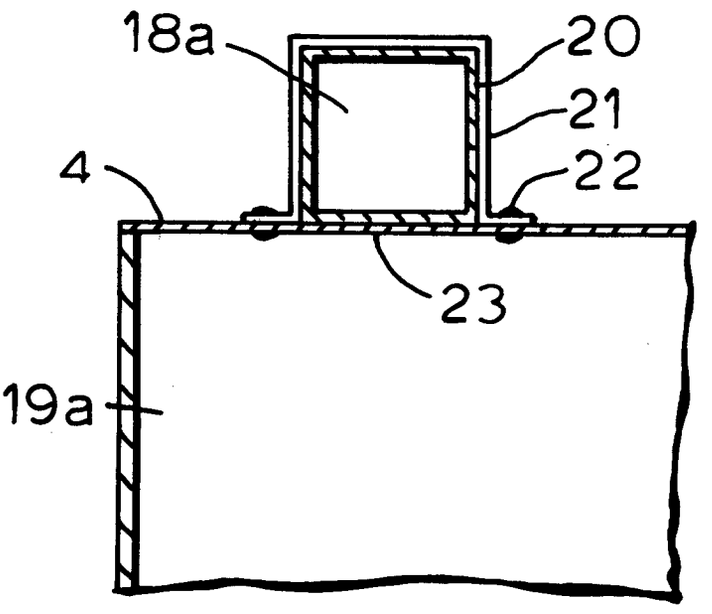


FIG. 3



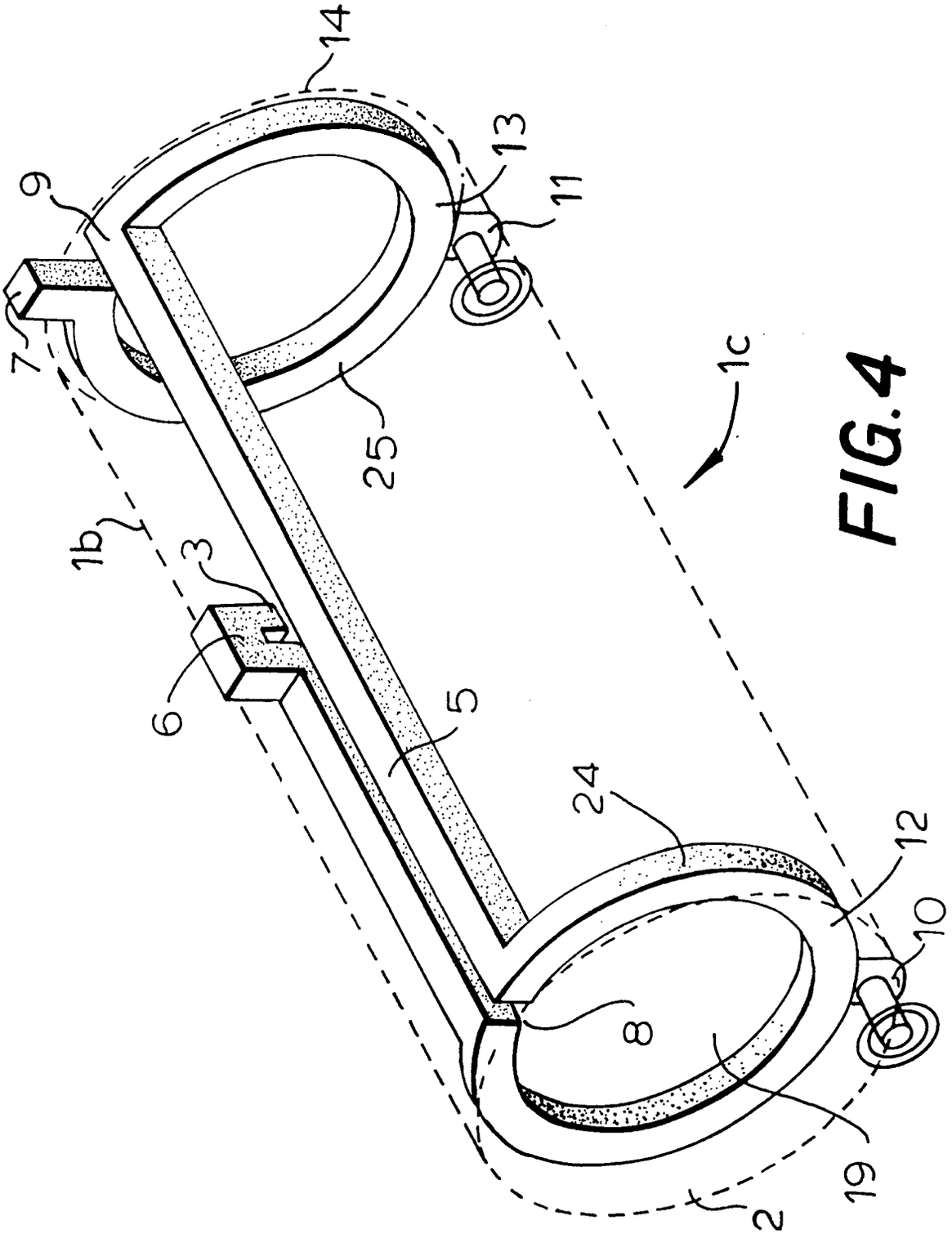


FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 93 20 3071

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	US-A-3 966 078 (JOHNSON ET AL.) * the whole document *	1-4,7,10	B65D90/34
X	PATENT ABSTRACTS OF JAPAN vol. 7, no. 9 (M-185)(1154) 14 January 1983 & JP-A-57 167 826 (TOYOTA JIDOSHA KOGYO K.K.) 15 October 1982 * abstract *	1,9	
D,A	US-A-4 492 244 (CHINN ET AL.)		

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

B60K
B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 February 1994	Topp-Born, S

CATEGORY OF CITED DOCUMENTS

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