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(72) Inventor: **Li, Ben**
County Down, BT18 9LF (GB)

(74) Representative: **Wallace, Alan Hutchinson**
F. R. Kelly & Co.
4 Mount Charles
Belfast BT7 1NZ,
Northern Ireland (GB)

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(71) Applicant: **Li, Ben**
County Down, BT18 9LF (GB)

(54) **Fill limiter for liquid storage tanks**

(57) A fill limiter (10) for a liquid storage tank, the fill limiter comprising a body (12), a valve mechanism at least partially located in the body, and means for operating the valve mechanism between an open state and a closed state. The operating means includes a float (28) movable with respect to the body, wherein the float includes at least one liquid engaging surface (35) that is obliquely disposed with respect to the direction of movement of the float. The float preferably includes a frustum shaped portion for engaging with the liquid. The fill limiter is suitable for installation in a tank at a variety of angular dispositions.

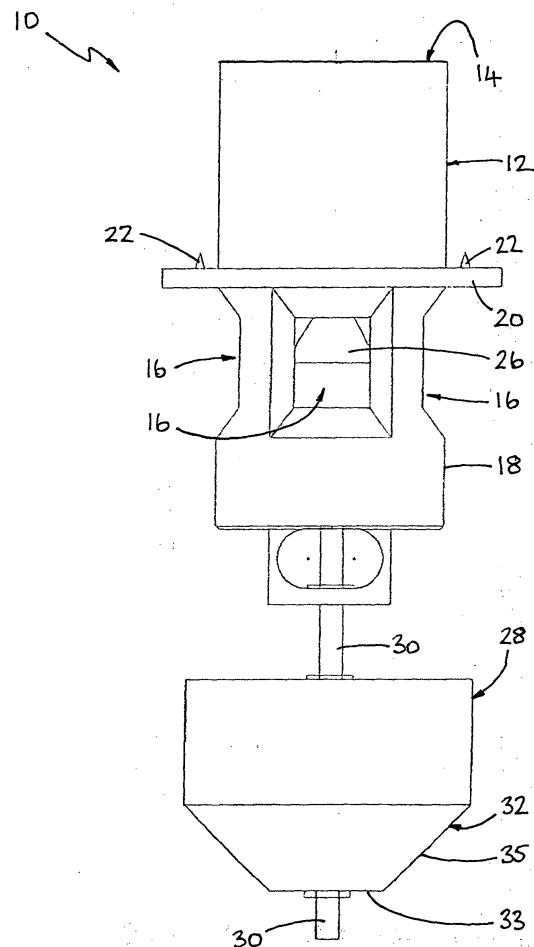


FIG. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a fill limiter for a liquid storage tank, especially liquid fuel storage tanks.

BACKGROUND TO THE INVENTION

[0002] French Patent Application FR 2 476 790 discloses an example of a known fill limiter for a liquid storage tank. The fill limiter comprises a hollow body having an inlet and an outlet. A valve mechanism is at least partially incorporated into the body and is operable between an open state, in which liquid may pass through the body via the inlet and the outlet, and a closed state in which the valve mechanism blocks the outlet. The valve mechanism is coupled to a float which is moveable with respect to the body. The position of the float with respect to the body determines the state of the valve mechanism.

[0003] A problem with the fill limiter of FR 2 476 790 is that it is only suitable for use in a vertical orientation, i.e. where the direction of movement of the float with respect to the body is generally vertical. Accordingly, the fill limiter of FR 2 476 790 is only suitable for use with tanks having inlets that are generally horizontally disposed.

[0004] It would be desirable, therefore, to provide an improved fill limiter suitable for use with a wider variety of tanks.

[0005] Accordingly, a first aspect of the invention provides a fill limiter for a liquid storage tank, the fill limiter comprising a body, a valve mechanism at least partially located in the body, and means for operating the valve mechanism between an open state and a closed state, the operating means including a float movable with respect to the body, wherein the float includes at least one liquid engaging surface that is obliquely disposed with respect to the direction of movement of the float.

[0006] Preferably, the float includes at least two liquid engaging surface portions that are generally obliquely disposed with respect to one another. The at least one liquid engaging surface may generally planar or generally curved or rounded.

[0007] In a preferred embodiment, the float includes a liquid engaging portion comprising a generally planar end surface that is substantially perpendicularly disposed with respect to the direction of movement of the float, and one or more side surfaces that are generally obliquely disposed with respect to the direction of movement of the float. Preferably, the liquid engaging portion is generally frustum-shaped, e.g. frusto-conical or frusto-pyramidal.

[0008] The fill limiter is particularly suited for use in applications where the tank, being for example a domestic or commercial liquid fuel tank, has an inlet comprising an aperture in a wall of the tank for receiving the

nozzle of a liquid dispensing apparatus, carried by, for example, a fuel tanker, vehicle. A portion of the body of the fill limiter may be shaped and dimensioned to be fitted in said inlet such that liquid which flows, during use, into said tank passes through the body. Typically, said body portion is shaped and dimensioned to receive the nozzle of the liquid dispensing apparatus. The fill limiter is particularly suited for use in applications where the tank inlet is disposed, during use, obliquely with respect to horizontal.

[0009] In preferred embodiments, the float is movable in an axial direction. Typically, the axial direction is coincident with the longitudinal axis of the fill limiter. The valve mechanism may include a blocking element located in the body, the position of the blocking element determining whether the valve mechanism adopts the open state or the closed state, and wherein the blocking element is coupled to the float and is movable, in said axial direction, within the body in response to movement of the float.

[0010] Preferably, the float is formed at least partially from a material, preferably a thermoplastic material, that includes an anti-static agent.

[0011] Preferably, the float is carried by a rod or other member, such that the location of the float on the rod with respect to the body is adjustable. Typically, the rod or other member couples or connects the float to the body.

[0012] From a second aspect, the invention provides a tank installation comprising the fill limiter of the first aspect of the invention fitted to a liquid storage tank, especially a liquid fuel storage tank. In the preferred embodiment, the fill limiter is fitted into the inlet of a tank, the inlet being orientated such that the longitudinal axis of the fill limiter is obliquely disposed with respect to horizontal, the float being movable in a direction substantially parallel with or coincident with said longitudinal axis.

[0013] Further advantageous aspects of the invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Embodiments of the invention will now be described by way of example and with reference to the accompanying drawings in which like numerals are used to indicate like parts and in which:

Figure 1 is a side view of a fill limiter embodying the invention; and

Figure 2 is a side view of a fill limiter embodying the invention and having an alternatively shaped float.

DETAILED DESCRIPTION OF THE DRAWINGS

[0015] Referring to the drawings there is shown, gen-

erally indicated as 10, a fill limiter (also known as an overflow device) for a liquid storage tank, especially, but not exclusively, a liquid fuel, for example oil or LPG (liquid petroleum gas), storage tank.

[0016] The fill limiter 10, which may for example be generally similar to the fill limiter described in FR 2 476 790, comprises a hollow body 12 having an inlet 14 an outlet 16. The body 12 is conveniently open-ended at one end to provide the inlet 14. In the preferred embodiment, the outlet 16 is formed in a side wall 18 of the body and is thus generally perpendicularly disposed with respect to the inlet 14. Preferably, the outlet 16 takes the form of a plurality of apertures, spaced-apart around the periphery of the body 12. A flange 20 is preferably provided around the external periphery of the body at a location between the inlet 14 and outlet 16. The flange 20 preferably carries one or more spikes 22, spaced-apart around the periphery of the body 12 and facing generally towards the inlet 14.

[0017] A valve mechanism 24 is at least partially incorporated into the body 12. The valve mechanism 24 comprises a blocking element 26 and means for actuating the blocking element 26 between an open state, in which liquid may pass into the body 12 via the inlet 14 and may exit the body 12 via the outlet 16, and a closed state, in which the blocking element 26 blocks, or substantially blocks, the outlet 16 (with respect to the inlet 14) so that liquid is substantially prevented from passing therethrough. The blocking element 26 is typically slidable within the body 12. The actuating means comprises a float 28 which is moveable with respect to the body 12 and which is coupled to the blocking element 26, conveniently by a rod 30 or other member. In the preferred embodiment, the internal surface (not shown) of the body 12 is shaped to define a valve seat (not shown) and the blocking element 26 is correspondingly shaped so that, when in the blocking state, it is seated in the valve seat thereby preventing liquid from passing from the inlet 14 to the outlet 16. The arrangement is such that, in a normal use orientation where the inlet is located above the outlet 16, the blocking element 26 may adopt the open state when under the influence of gravity alone.

[0018] In use, the fill limiter 10 is fitted to a liquid storage tank (not shown), typically a liquid fuel storage tank, so that at least the outlet 16 and the float 28 are located within the tank. Typically, The tank has a mouth or inlet that is shaped and dimensioned to receive the nozzle of a liquid dispensing device (not shown), for example the nozzle on the end of a hose of a fuel tanker (not shown).

[0019] When fitted to a tank, fill limiter 10 is positioned so that the inlet 14 is generally in register with the mouth or inlet (not shown) of the tank. In the illustrated embodiment, at least part of the portion of the body 12 between the flange 20 and the inlet 14 is located in, or passes through, the tank inlet. The flange 20, or at least the spikes 22 when present, engages with the internal surface of the tank. The arrangement is such that the fill

limiter 10 allows the nozzle to be inserted into the tank inlet as normal. In the illustrated embodiment, the nozzle, when inserted into the tank inlet, is also located in the body 12 of the fill limiter 10, i.e. at least a portion of the body 12 (in the present example the portion between the flange 20 and the inlet 14) is shaped and dimensioned to receive the nozzle. Hence, liquid (not shown) fed into the tank passes through the body 12 when the valve mechanism is open.

[0020] The float 28 is located within the tank and is suspended below the body 12, carried by the rod 30. The arrangement is such that, when the tank is not nearly full, the float 28 does not come into contact with the contents of the tank, i.e. the float 28 is suspended above the contents of the tank, and the blocking member 26 adopts the open state under gravity. As the tank fills up, the surface of the liquid within the tank rises vertically and engages with the float 28. As the liquid level continues to rise, the liquid surface exerts pressure on the float 28 thereby actuating the float 28 towards the body 12. Hence, the rod 30 is also actuated in a direction towards the body 12. Movement of the float 28, and therefore of the rod 30, towards the body 12 causes, either directly or indirectly, the blocking element 26 to adopt the closed state. This may be achieved by direct action of the rod 30 on the blocking element 26 or, preferably, indirectly using the pressure of the incoming liquid (as is described in FR 2 476 790).

[0021] In the illustrated embodiment, the float 28 moves in an axial direction A1 which, conveniently, is along the longitudinal axis of the rod 30 and which direction may be said to be the longitudinal axis of the fill limiter 10. Conveniently, the blocking element 26 also moves, or slides, in said axial direction in response to movement of the float 28.

[0022] The float 28 has at least one liquid engaging surface. In the illustrated embodiment, the portion of the float 28 for engagement with the liquid contents of the tank, i.e. the in-use bottom portion 32 of the float 28 (typically the portion of the float 28 that is distal the body 12), is shaped to provide at least two liquid engaging surface portions that are generally obliquely disposed with respect to one another. The liquid engaging surface portions may be generally planar or generally curved. In Figure 1, the bottom portion 32 of the float 28 is generally frustum-shaped, e.g. frusto-conical or frusto-pyramidal, with the longitudinal axis of the frustum-shaped portion 32 being substantially coincidental with, or parallel with, the longitudinal axis of the rod 32 and the narrower end surface 33 of the frustum facing, in use, downwardly, or generally away from the body 12. In Figure 2, the float 128 has an alternatively shaped liquid engaging, or bottom, portion 132 which has a generally planar bottom surface 133 and a generally curved or rounded side surface 135.

[0023] In both of the preferred embodiments, the liquid engaging, or bottom, portion 32, 132 of the float 28, 128 comprises a generally flat or planar bottom surface

33, 133 (i.e. the surface distal the body 12) that is generally perpendicularly disposed with respect to the direction of movement of the float 28, 128 (which in the preferred embodiment is generally perpendicular to the longitudinal axis of the rod 30), and one or more side surfaces 35, 135 that are generally obliquely disposed with respect to the respective bottom surface 33, 133 (and therefore with respect to the direction of movement of the float 28, 128).

[0024] In alternative embodiments (not illustrated) the bottom portion may be generally rounded, e.g. generally hemispherical, in shape, or generally conical or pyramidal in shape. It is not essential to have a planar bottom surface.

[0025] In use, if the fill limiter 10 is fitted to a tank such that its longitudinal axis is generally vertically disposed (as shown in Figures 1 and 2), then it may operate in a generally similar manner to the fill limiter of FR 2 476 790 - the rising liquid surface (not shown) first engages with the bottom surface 33, 133 of the float 28, 128 to push the float 28, 128 upwardly (the bottom surface 33, 133 being generally parallelly disposed with respect to the liquid surface).

[0026] However, if the fill limiter 10 is fitted to a tank such that its longitudinal axis is inclined, or oblique, with respect to vertical, then the rising liquid surface first engages with the side surface 35, 135. Because the side surface 35, 135 is generally inclined with respect to the direction of movement of the float 28, 128, at least some of the thrust generated by the rising liquid level serves to actuate the float 28, 128 towards the body 12.

[0027] Hence, the fill limiter 10 is suitable for use with tanks where the inlet is not horizontally disposed and where, when fitted, the longitudinal axis of the limiter 10 is not vertically disposed.

[0028] The angle of inclination of the side surface 35, 135 may be, for example between 20° and 70° and preferably approximately 45° with respect to the direction of movement of the float 28, 128. The fill limiter 10 is particularly suitable for use in cases where, when installed, the longitudinal axis of the fill limiter 10 is disposed at between 0° and 50°, but preferably between 0° and 40° with respect to the vertical.

[0029] In preferred embodiments, the location of the float 28, 128 on the rod 30 is adjustable, by any suitable means (e.g. one or more releasable bolts or clips 40), so that the spacing between the float 28, 128 and the body may be varied. This allows a user to adjust the fill level of the tank in which the limiter 10 is to be installed. For example, locating the float 28, 128 as far away as possible from the body 12 causes the valve mechanism to close at a lower fill level than if the float 28, 128 is located relatively close to the body 12.

[0030] The float 28, 128 is formed from a material, typically plastics, that floats on the, or each, liquid with which it is intended to be used. It is also preferred that the float 28, 128, or at least its outer surface, is formed from a thermoplastic material, e.g. polyethylene or poly-

propylene. This prevents liquid from being absorbed into the float 28, 128 (liquid absorption tends to increase the weight of the float 28, 128 and thereby impede the operation of the fill limiter 10).

[0031] It is further preferred that the float 28, 128, or at least its outer surface is formed from a material with anti-static properties, or to which a conventional anti-static agent has been added. This reduces the risk of electrical discharges within the tank which is particularly advantageous in cases where the liquid is flammable.

[0032] Fill limiters embodying the invention may be provided integrally with a liquid storage tank, or may be configured for retro-fitting to existing tanks. The illustrated fill limiter is suitable for retro-fitting.

[0033] The invention is not limited to the embodiments described herein which may be modified or varied without departing from the scope of the invention.

20 Claims

1. A fill limiter for a liquid storage tank, the fill limiter comprising a body, a valve mechanism at least partially located in the body, and means for operating the valve mechanism between an open state and a closed state, the operating means including a float movable with respect to the body, wherein the float includes at least one liquid engaging surface that is obliquely disposed with respect to the direction of movement of the float.
2. A fill limiter as claimed in Claim 1, in which the float includes at least two liquid engaging surface portions that are generally obliquely disposed with respect to one another.
3. A fill limiter as claimed in Claim 1 or 2, wherein said at least one liquid engaging surface is generally planar or generally curved.
4. A fill limiter as claimed in any preceding claim, wherein the float includes a liquid engaging portion comprising a generally planar end surface that is substantially perpendicularly disposed with respect to the direction of movement of the float, and one or more side surfaces that are generally obliquely disposed with respect to the direction of movement of the float.
5. A fill limiter as claimed in Claim 4, wherein said liquid engaging portion is generally frustum-shaped.
6. A fill limiter as claimed in any preceding claim, wherein the tank has an inlet comprising an aperture in a wall of the tank, a portion of the body being shaped and dimensioned to be fitted in said inlet such that liquid which flows, during use, into said tank passes through the body.

- 7. A fill limiter as claimed in Claim 6, wherein said body portion is shaped and dimensioned to receive a nozzle of a liquid dispensing apparatus.

- 8. A fill limiter as claimed in any preceding claim, wherein said float is movable in an axial direction. 5

- 9. A fill limiter as claimed in Claim 8, wherein said valve mechanism includes a blocking element located in the body, the position of the blocking element determining whether the valve mechanism adopts the open state or the closed state, and wherein the blocking element is coupled to the float and is movable, in said axial direction, within the body in response to movement of the float. 10
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- 10. A fill limiter as claimed in any preceding claim, wherein the float is formed at least partially from a material, preferably a thermoplastic material, that includes an anti-static agent. 20

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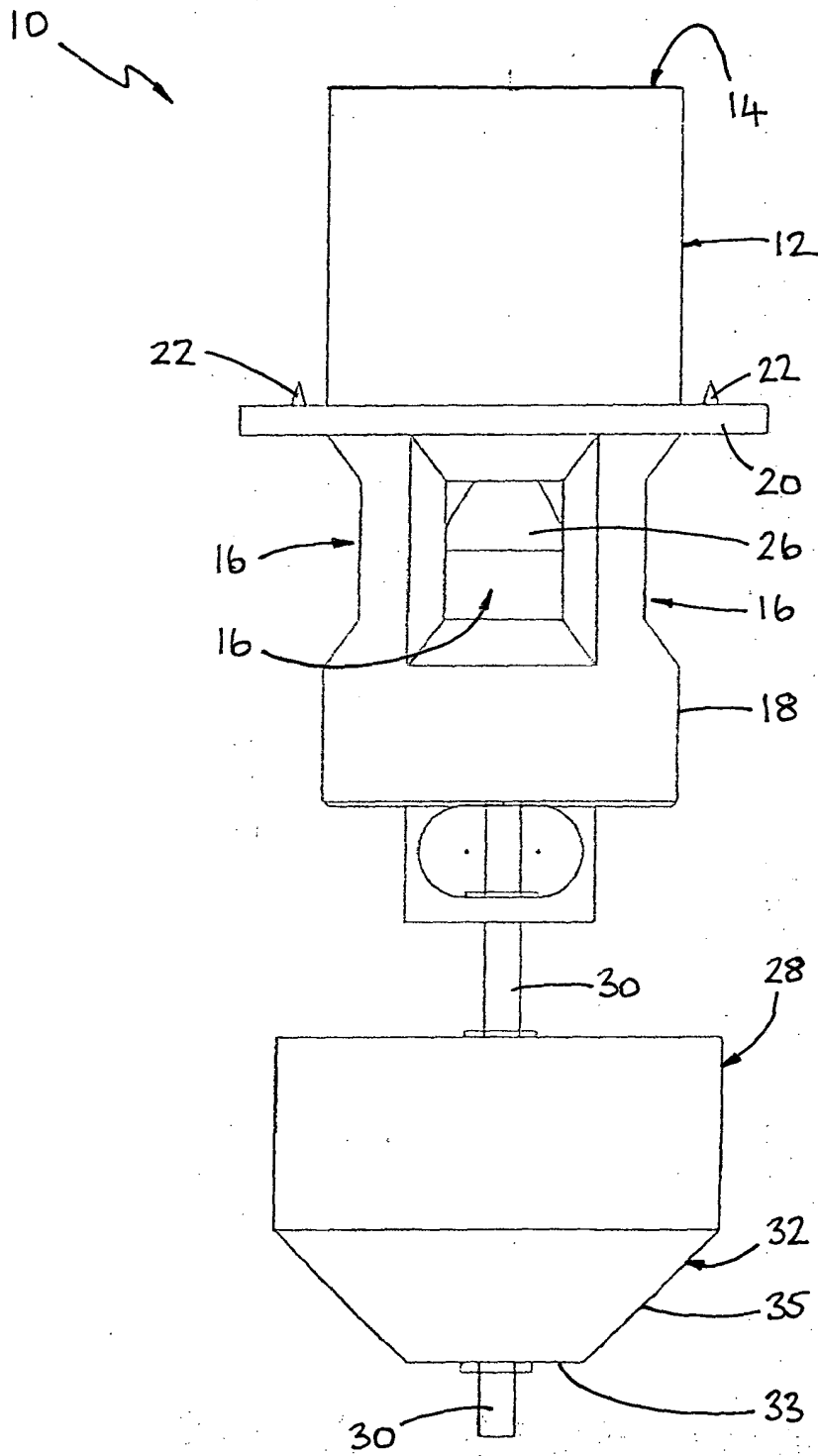


FIG. 1

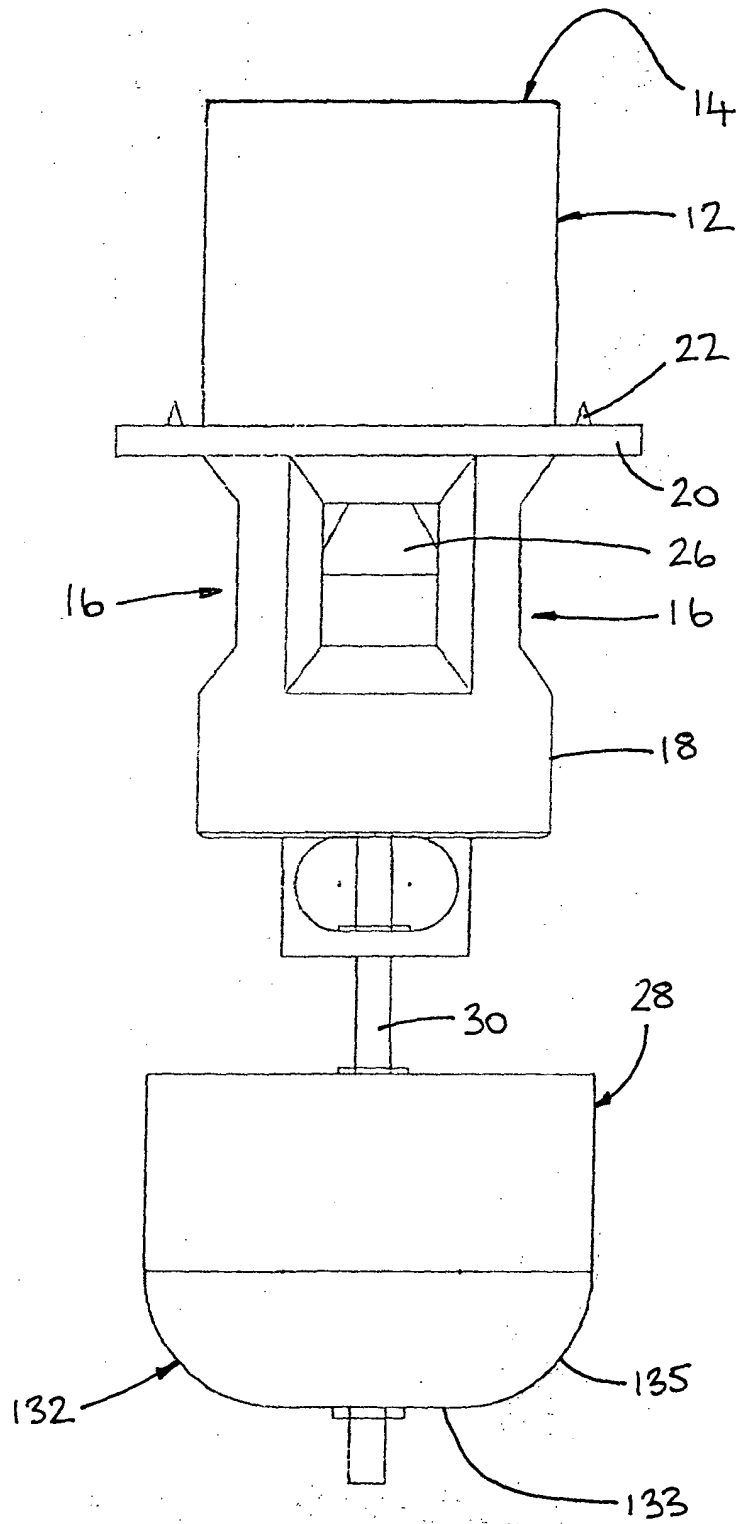


FIG. 2



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.7)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B67D B65D F16K
Place of search		Date of completion of the search	Examiner
The Hague		6 July 2005	Smolders, R
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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