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(54) **Liquid-fillable barrier**

(57) The invention pertains to a liquid-fillable barrier (1) comprising a tubular member (2) having a base (3) and, when deployed, two upwardly tapering sidewalls (4), an elongated cavity having a central axis, at least a first partition (6) wall fixed inside the tubular member (2) and dividing the cavity in at least two compartments (8, 9), and at least one spout (12) for the introduction of a

liquid, preferably water, into the cavity. The first partition wall (6) extends, when deployed, parallel to the central axis, dividing the cavity of the member into a lower compartment (8) and at least one upper compartment (9). By dividing the cavity into horizontally extending compartments, a stable basis can be provided prior to filling the other compartment(s).

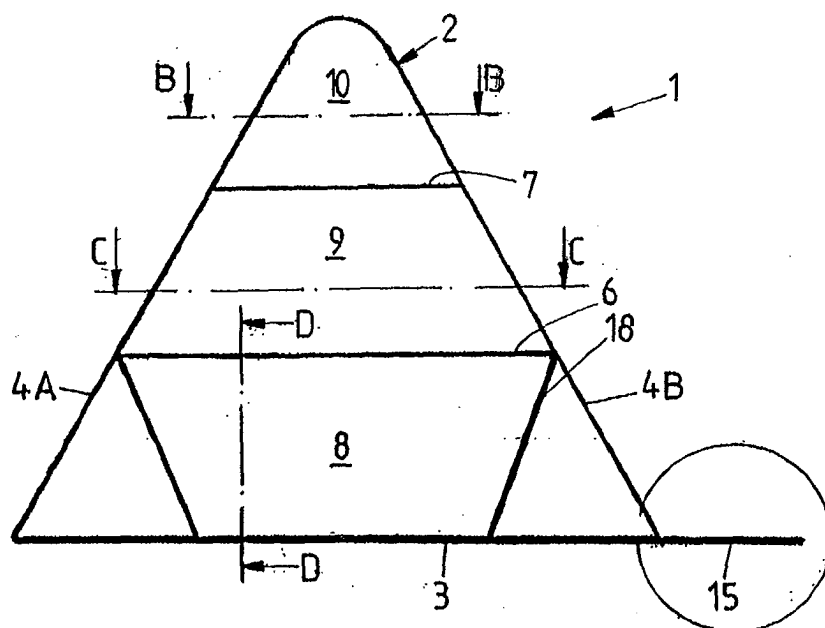


Fig.2

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Description

[0001] The invention pertains to a liquid-fillable barrier comprising a tubular member having a base and, when deployed, two upwardly tapering sidewalls, an elongated cavity having a central axis, at least a first partition wall fixed inside the tubular member and dividing the cavity in at least two compartments, and at least one spout for the introduction of a liquid, preferably water, into the cavity.

[0002] Such barriers are known e.g. from US 5,040,919, which relates to a containment structure for controlling flood water or spilled liquids comprising an elongated, triangular flexible container to be placed where needed to form a stable, water-tight barrier. The containment structure has a spout for introduction of water into the container, a front flap for anchoring the container, and has end pieces adapted to be used for sealing the end of the container against irregular objects or another container. A floating pump assembly can be provided for filling the container with flood waters. The triangular shape is maintained by (vertical) gussets (14) of flexible material, attached by welding or adhesion to the inside of the container (tube).

[0003] US 5,865,564 relates to a fluid-fillable barrier includes a tubular, impermeable membrane and at least one tension member. The membrane has a first attachment area and a second attachment area. The tension member secures between, and extends from, the first attachment area to the second attachment area. When in tension, the tension member may pivot with respect to the membrane, and has a taut length which is less than one-half of the perimeter of a cross section of the membrane, the length and perimeter being measured at a common cross-section taken perpendicular to a longitudinal axis of the membrane.

[0004] In practice, liquid-fillable barriers, when actually being filled, do not assume the shape contemplated in theory and the side walls will extend (far) beyond the boundaries of the base. Also, the width to height ratio of the filled barriers is generally (too) high and stability is poor.

[0005] It is an object of the present invention to provide an improved liquid-fillable barrier.

[0006] To this end, the first partition wall, when deployed, extends parallel to the central axis, preferably horizontally, dividing the cavity of the member into a lower compartment and at least one upper compartment.

[0007] By dividing the cavity into horizontally extending compartments, a stable basis can be provided prior to filling the other compartment(s). Favourable (low) width to height ratios, e.g. of about 1.2, can be obtained at good or at least adequate stability, and the volume of cavity can be kept relatively small allowing relatively rapid filling and emptying of the barrier.

[0008] To facilitate the filling of the lowest compartment, it is preferred that at least one spout is positioned in one of the sidewalls of the barrier, just below the (first)

partition wall.

[0009] By providing at least a second partition wall fixed inside the member and dividing the upper compartment into at least two further compartments, a stable barrier can be erected gradually from the ground up.

[0010] It is preferred that the height of at least the lowest compartment, but preferably most or all compartments is in a range from 15 to 60 cm, especially from 25 to 50 cm thus allowing an appropriate balance between, on the one hand, the number of compartments that must be filled and, on the other hand, the stability provided by each of the compartments.

[0011] It is preferred that the barrier comprises at least one tension member or group of tension members fixed between a sidewall and the base. Such tension members suppress bulging of the base, i.e. keep the base level.

[0012] It is further preferred that the far ends of the tubular member are closed, e.g. by the same material used for the tubular member itself, and a fastening means, preferably one of the constituent parts of Velcro, is provided at or near at least one of these ends along the greater part of the circumference. With such fastening means and an cover, preferably made of the same of a similar material as the barrier itself, adjoining barriers can be connected to one another so as to provide continuity.

[0013] By providing barriers according to the invention with inclined ends, the course of the barrier can be adapted to e.g. the course of a river or the boundaries of the premises of a chemical plant without compromising the water tightness of the barrier.

[0014] The invention will now be explained in more detail with reference to the drawings, which show various preferred embodiments of the barrier in hand.

[0015] Figures 1 and 2 show respectively a side view and a cross-section (A-A) of a barrier according to the present invention.

[0016] Figures 3A and 3B show two different variants of one aspect of the barrier according to Figures 1 and 2.

[0017] Figures 4 and 5 show respectively a second (B-B) and a first partition wall (C-C) of the barrier according to Figures 1 and 2.

[0018] Figure 6 shows one of the two tension member (D-D) of the barrier according to Figures 1 and 2.

[0019] Figure 7 show the forces exerted on the barrier when installed.

[0020] Figure 8 shows abutting ends of two adjoining barriers.

[0021] Figure 9 shows a connection between the ends according to Figure 8 with a fastening means.

[0022] Figure 10 is a perspective view of a fastening means as used in Figure 9.

[0023] Figure 11 shows a connection between barriers having oblique ends.

[0024] Figure 12 shows a cross-section of a barrier according to the invention installed at sea.

[0025] Figures 13 and 14 illustrate a fastening system

for connecting a plurality of the barriers according Figure 12.

[0026] Figure 15 is a side view of the barrier according to Figure 12.

[0027] Within the framework of this invention, the words 'up', 'upper', 'low', 'lower' and the like refer to a deployed barrier, either on land or in water. Further, identical parts and parts performing the same function or substantially the same function are denoted by the same numeral.

[0028] Figures 1 and 2 show respectively a side view and a cross-section (A-A) of a preferred liquid-fillable barrier 1 according to the present invention deployed on land and including a tubular member, in this case a tube 2 comprising a base 3 and tapering side walls 4a, 4b. In this particular example, the deployed barrier 1 has a length in a range from 10 to 30 m, e.g. 20 m, a triangular cross-section, a width at the base 3 of about 1,2 m and a height of about 1 m. The centre of gravity is located at roughly one-third of the total height, resulting in good stability. Other suitable configurations included trapezium and wedge-shaped cross-sections.

[0029] The tube 2 is made of a flexible and impermeable material, e.g. a woven polyester cloth made impermeable by impregnating it with a PVC coating on either side, yielding a laminate of 670 g/m². The ends 5 of the tube 2 are sealed by means of triangular sheets of the same material, which have been welded ultrasonically or glued to the circumference of the tube 2. The lower surface of the base 3 can be provided with friction enhancing features, such as protruding dots or ribs embossed in the outer PVC coating.

[0030] Two horizontal baffles 6, 7 have been welded ultrasonically or stitched and sealed to the inner surface of the side walls 4a, 4b and divide the cavity of the tube 2 into three compartments 8, 9, 10 of substantially equal height, e.g. 35 cm, and extending parallel to the ground on which the barrier has been deployed. The baffles 6, 7 are provided with a staggered pattern of small holes 11, having a diameter in a range from 1 to 5 mm, e.g. 3 mm, at a mutual distance of less than 50 cm, for instance 30 cm. As will be explained below, these holes allow air to vent from a lower compartment to an upper compartment during filling and prevent air pockets from forming between each of the baffles and the rising water in the compartment beneath it.

[0031] Each of the compartments 8, 9, 10 is provided, near its top, with a filling valve 12, preferably a self-sealing quick release coupler, and an additional outlet, e.g. a screw cap 13, for emptying the compartments after use. The upper compartment is further provided with a manually operated shut-off valve 14.

[0032] As shown in Figures 2, 3A and 3B, the tube 2 comprises an extension, e.g. a flap 15, on its front side, i.e. the side facing the water to be stopped. As shown in Figure 7, this flap 15, during use, will be forced to the ground by the column of water on top of it and will thus increase the water-tightness of the seal between the

base 3 of the tube 2 and the ground as well as the stability of the tube 2 itself. To prevent the flap 15 from being lifted by e.g. gusts of wind before water reaches the tube 2, it can be nailed to ground or preferably held down by an auxiliary liquid-fillable tube 16 (Figure 3A) or by concrete girders 17 (Figure 3B), which is/are part of the flap 15 or attached thereto.

[0033] It is preferred that the barrier 1 comprises e.g. two sheet-like tension member 18 or groups of tension members fixed, again by ultrasonic welding or stitching and sealing, between the sidewalls 4 and the base 3. Such tension members 18 suppress bulging of the base 3, especially during filling, and hence keep the base 3 level.

[0034] The tension members 18 are provided, near the base 3, with a plurality of semicircular holes 19 having a diameter of e.g. 8 cm to prevent the tension members 18 from obstructing the flow of water within the lowest compartment 8.

[0035] Adjoining tubular members are preferably connected to one another by fastening means located at or near the ends of these members. In Figures 8 to 11, one of the constituent parts 20A of Velcro is glued, e.g. by means of an acrylate glue, to the side walls 4a, 4b at a distance of 10 cm from ends of the tube 2. Two strips of the remaining constituent part 20B of Velcro are glued to a rectangular cover 21, parallel to the relatively long sides. As shown in Figure 10 the length of the cover 21 can be selected such as to extend over the sidewalls 4 of the tubes 2 and optionally over the flaps 15 or over the entire circumference of the tubes 2, as indicated by the dotted lines.

[0036] By providing barriers according to the invention with inclined ends, i.e. ends that build an angle other than 90 degrees with the central axis of the tube 2, can be adapted to e.g. the course of a river or the boundaries of the premises of a chemical plant without compromising the water tightness of the barrier.

[0037] The number and length of the barriers required as well as the inclination of the ends of the barriers needed to follow the shape of a river or the boundaries of premises along or around which the barrier should be deployed during an emergency, can be established by means of e.g. aerial photography.

[0038] The barrier according to the invention can be stored, e.g. near a river, chemical plant or other facility that may require containment of water or another extinguishing agent, folded or rolled-up on trolleys, trailers or the like. During a drill or an emergency, the barrier 1 is transport to the site in question and deployed by unfolding or unrolling along a required course and filling the lowest compartment of the barrier, through the filling valve, with water, e.g. taken from a river or provided by a fire department. During filling, the lowest compartment takes the shape of a trapezium with the other, still empty, compartments stacked on top of it, and forms a stable basis for filling further compartments. Since the surface on which the barrier is placed often is not flat, air pockets

may form between the rising water in the lowest compartment and the lowest baffle. The air in these pockets will vent through the holes and into the compartment directly above the lowest compartment, thus further increasing the amount of water contained in the lowest compartment, preferably to 100%, and further increasing its stability. As soon as the lowest compartment is sufficiently filled, the filling valve is closed and the compartment above it is filled, and so on. Adjoining barriers are subsequently connected by means of covers, such as the one shown in Figures 9, 10, and 11.

[0039] Figures 12 to 15 show an embodiment of the barrier 1 intended for use in water, e.g. at sea to contain an oil spill. The tube 2 of this barrier 1 is identical to the tube of the barrier shown in Figures 1 and 2, except for the absence of a flap (15), a width to height ratio of about 0.7 and a height of the compartment 8 just below the base 3 less than that of the other compartments. Further, this barrier 1 is provided with loops 22 along the edges of the base 3 and along the bottom edge of the lowest compartment 10. The spouts 12 are located in the base 3 and provided with ducts 22, 23 that extend passed or through one or more of the baffles 6, 7 and into the respective compartments 9, 10.

[0040] The barrier can be stored on a roll, which, in case of an emergency, such as an oil spill, can be placed in the hold of a ship. It can be deployed e.g. by unrolling a section of the barrier or one entire barrier of relatively limited length at a time, on the deck of the ship and e.g. confined between inclined rollers. The lowest compartment is subsequently filled with sea water through the said duct(s) 23. As soon as this compartment 10 is filled, the compartment 9 directly above it is filled. In order to provide sufficient buoyancy, the upper compartment 8 remains empty through the other duct(s) 22. Cables 24 comprising eyes 25 on either end are inserted in the loops 20 and the barrier 1 is lowered into the sea. Adjoining barriers can be firmly connected to one another by means of the eyes 25.

[0041] As a matter of course, the invention is not restricted to the above-described embodiments. E.g. other suitable materials for the tubular member and preferably also for the partition walls, tension member and/or flap include woven or nonwoven sheets or grids of e.g. polyester, nylon or aramid rendered sufficiently impermeable by means a single or double sided coating of e.g. PVC. Such sandwich structures preferably have a weight in a range of from 300 to 1500 g/m².

[0042] Further, instead of sheet-like tension members between the sidewalls and the base of the tube, it is possible to use rods, cords, ribbons or the like.

[0043] The width of base of the barrier according to the present invention can be freely selected. The width of the base is usually in a range from 0.5 to 3 m, preferably less than 2.4 m.

Claims

1. A liquid-fillable barrier (1) comprising a tubular member (2) having a base (3) and, when deployed, two upwardly tapering sidewalls (4), an elongated cavity having a central axis, at least a first partition (6) wall fixed inside the tubular member (2) and dividing the cavity in at least two compartments (8, 9), and at least one spout (12) for the introduction of a liquid, preferably water, into the cavity, **characterised in that**, the first partition wall (6) extends, when deployed, parallel to the central axis, dividing the cavity of the member into a lower compartment (8) and at least one upper compartment (9).
2. The barrier (1) according to claim 1, wherein at least one spout (12) is positioned in one of the sidewalls (4) of the barrier (1) and below the first partition wall (6).
3. The barrier (1) according to claim 1 or 2, wherein at least a second partition wall (7) is fixed inside the tubular member (2), dividing the upper compartment into at least two further compartments (9, 10).
4. The barrier (1) according to any one of the preceding claims, wherein the height of at least the lowest compartment (8), but preferably most or all compartments (8, 9, 10) is in a range of 15 to 60 cm, preferably 25 to 50 cm.
5. The barrier according to any one of the preceding claims, wherein the partition wall(s) (6, 7) is (are) rendered permeable, at least to air, by means of a plurality of openings (11).
6. The barrier (1) according to claim 5, wherein the openings (11) are distributed over the greater part, preferably the entire area of the partition wall(s) (6, 7) and that the openings (11) are less than 50 cm, preferably less than 30 cm apart.
7. The barrier (1) according to any one of the preceding claims, wherein at least one tension member (18) or group of tension members is fixed between a sidewall (4) and the base (3) so as to suppress bulging of the base (3).
8. The barrier (1) according to claim 7, wherein one end of the tension member(s) (18) is fixed to the sidewall (4) at or near the position where the first partition wall (6) is fixed to the sidewall (4) and the other end is fixed to the base (3).
9. The barrier (1) according to any one of the preceding claims, wherein the ends of the tubular member (2) are closed and a fastening means (20), preferably one of the constituent parts of Velcro, is pro-

vided at or near at least one of these ends (5) along at least the greater part of the circumference.

10. The barrier (1) according to anyone of the preceding claims, wherein at least one of the ends (5) builds an angle with the central axis. 5

11. The barrier (1) according to any one of the preceding claims and intended for use in water, wherein the spout (12) is provided with a duct (23, 24) that extends passed or through the partition wall(s) (6, 7). 10

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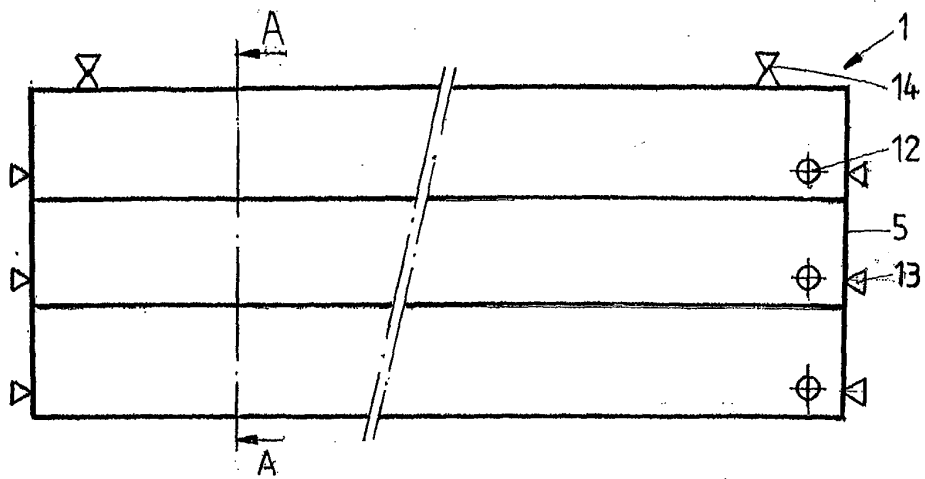


Fig.1

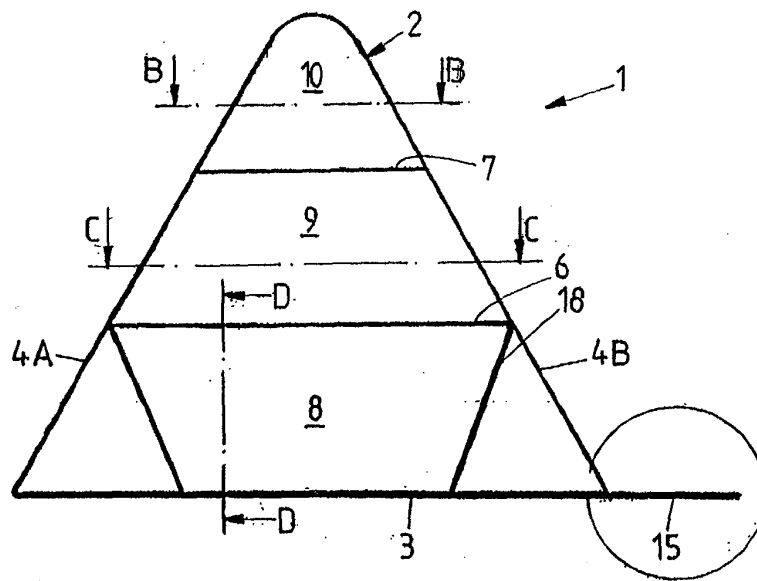


Fig.2

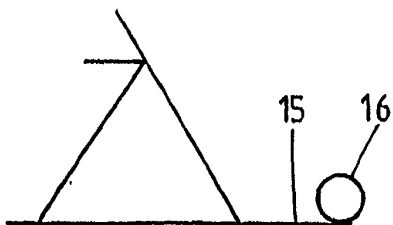


Fig.3A

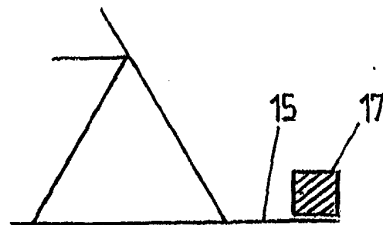


Fig.3B

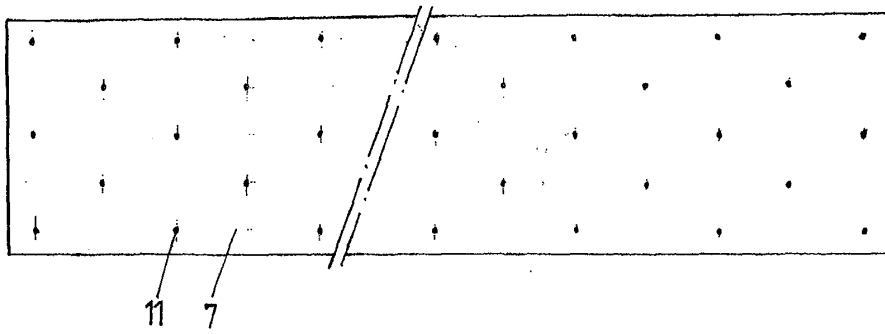


Fig. 4

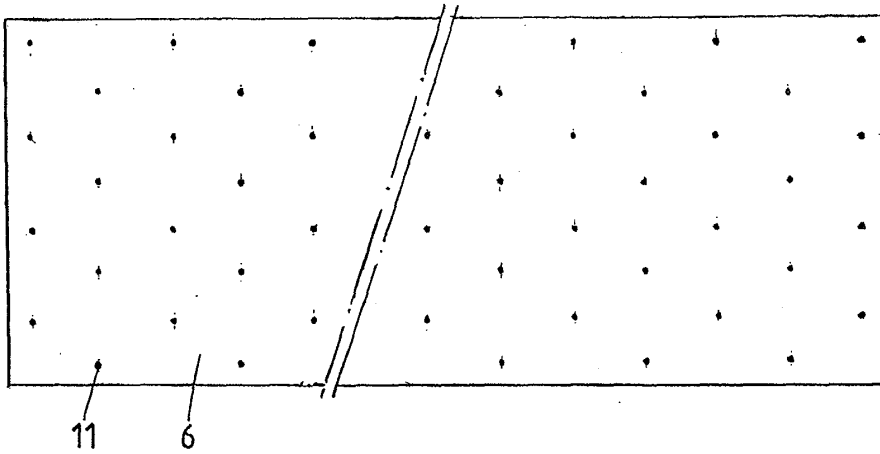


Fig. 5

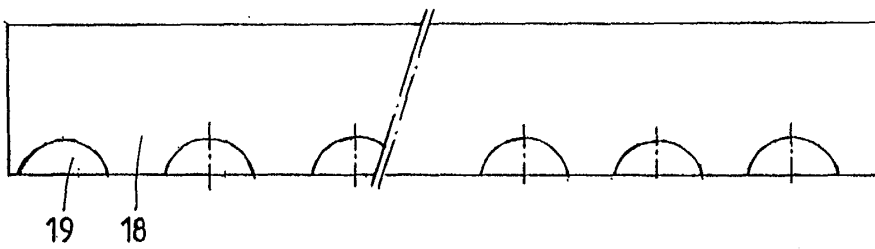


Fig. 6

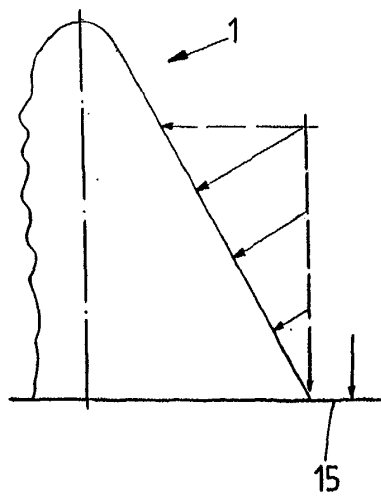


Fig. 7

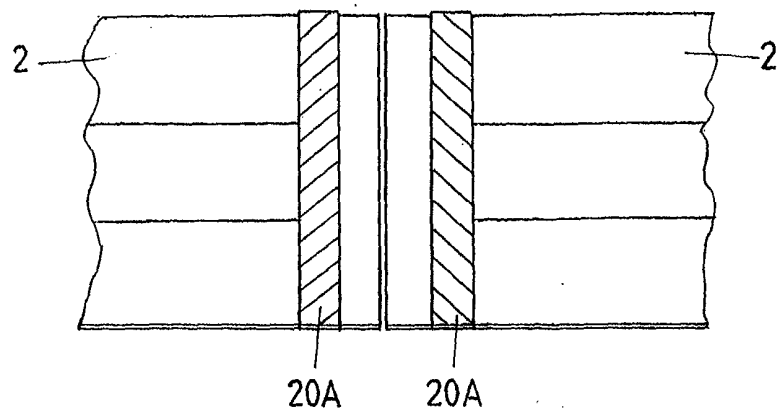


Fig.8

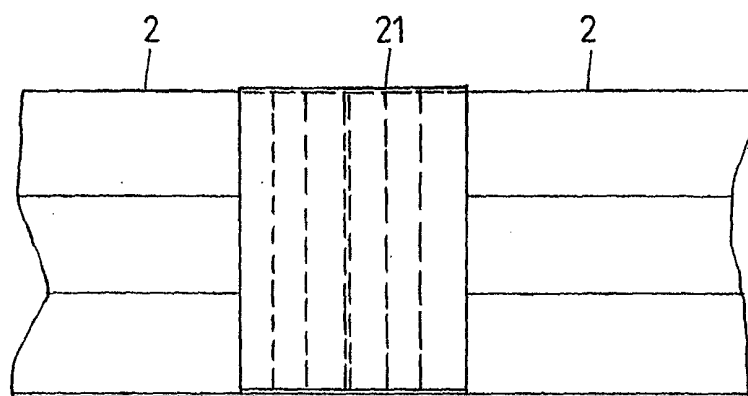


Fig.9

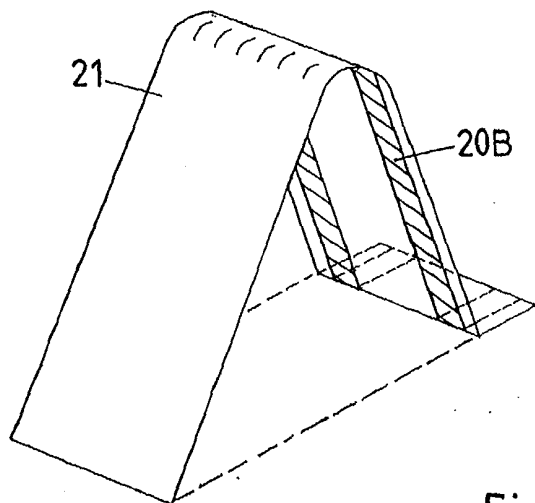


Fig.10

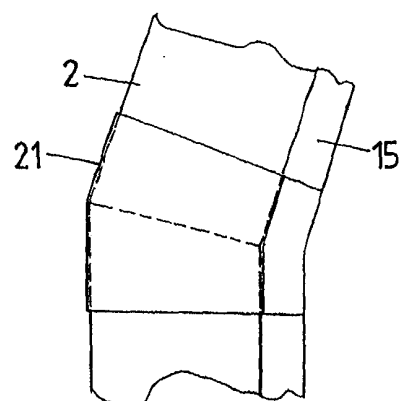
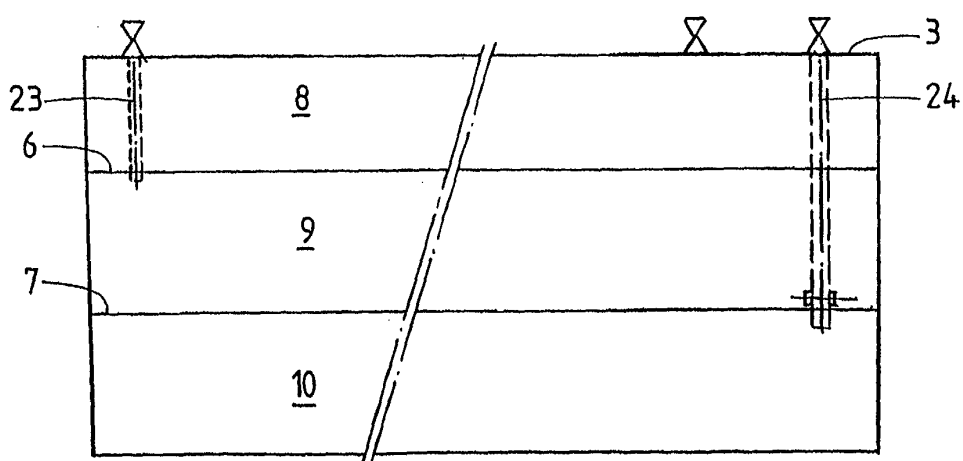
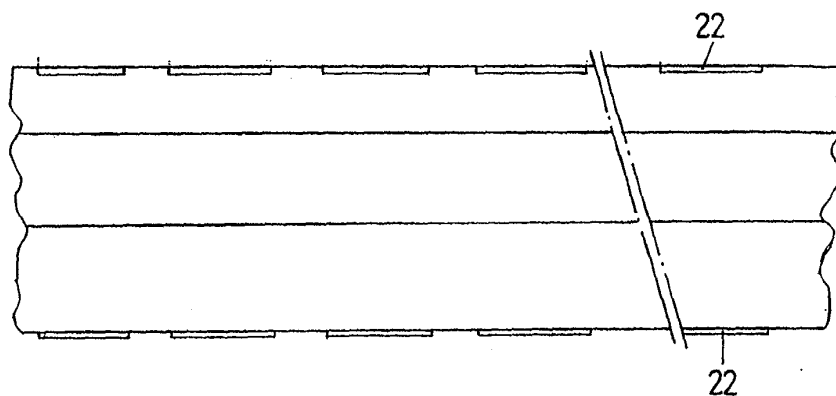
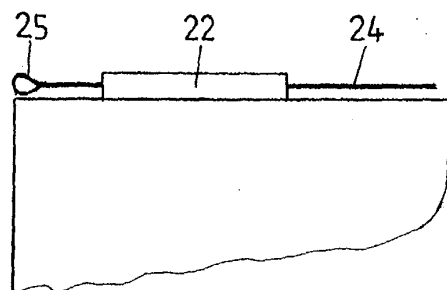
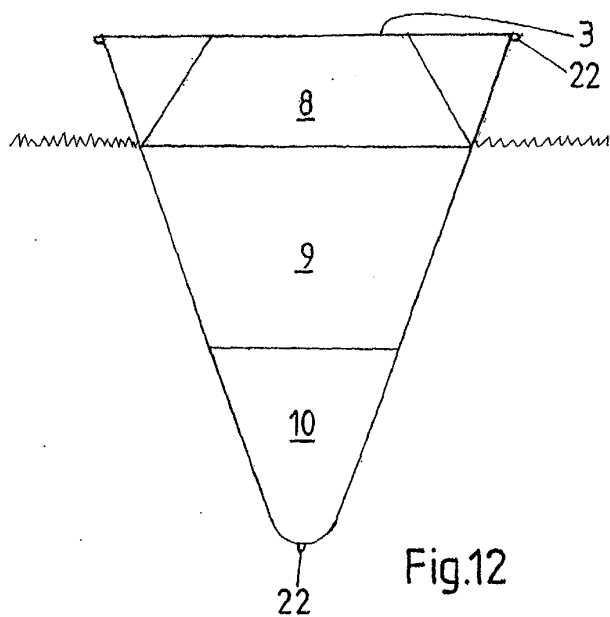


Fig.11





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EUROPEAN SEARCH REPORT

Application Number
EP 03 10 2695

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)
X	US 6 022 172 A (SIYAJ JAMAL MUSTAFA) 8 February 2000 (2000-02-08) * figures *	1-10	E02B7/00 E02B3/10
A	* column 4, line 67 - column 6, line 22 * * claims *	11	
X	US 6 164 870 A (BARUH BRADFORD G) 26 December 2000 (2000-12-26) * figures 2-8 *	1,2,4-6, 9-11	
A	* column 1, line 6 - line 7 * * column 1, line 55 - line 61 * * column 3, line 1 - line 46 * * column 4, line 6-11 * * column 4, line 17 - line 26 *	3	
X	WO 02 10519 A (RUBENA A S HRADEC KRALOVE ;VIK MILAN (CZ); EEPEK VACLAV (CZ); HOLE) 7 February 2002 (2002-02-07) * figure 4 *	1,2,4,9, 10	
	* page 2, paragraph 2 - paragraph 5 * page 3, Example 1: paragraphs 5-7 * page 4, paragraphs 1,5-7 * * page 5, paragraph 4 *		TECHNICAL FIELDS SEARCHED (Int.Cl.7) E02B
X	US 6 364 571 B1 (DOOLAEGE DAVID) 2 April 2002 (2002-04-02) * figures 1-3,5-5B,8,10,11 *	1-6,9-11	
	* column 1, line 18 - line 26 * * column 2, line 63 - column 3, line 2 * * column 3, line 18 - line 67 * * column 5, line 29 - line 37 * * column 10, line 1 - line 25 *		
A	GB 2 373 807 A (PADMORE CHRISTOPHER) 2 October 2002 (2002-10-02) * page 2, paragraph 2; figures 2,3,8 *	7,8	
	--- -/--		
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 26 November 2003	Examiner Isailovski, M
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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Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 10 2695

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)
A	CA 2 320 009 A (BOUDREAU GUY) 24 December 2000 (2000-12-24) * page 4; figures *	9	
A	US 5 298 175 A (WHIDDEN JR MALCOLM B) 29 March 1994 (1994-03-29) * abstract; figures 1A,1B *	9,11	
D,A	US 5 865 564 A (STEPHENSON THOMAS P ET AL) 2 February 1999 (1999-02-02) * figures *	1,3-6,9,10	
D,A	US 5 040 919 A (HENDRIX GLEN) 20 August 1991 (1991-08-20) * figures *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
Place of search MUNICH		Date of completion of the search 26 November 2003	Examiner Isailovski, M
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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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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26-11-2003

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 6022172	A	08-02-2000	NONE		
US 6164870	A	26-12-2000	NONE		
WO 0210519	A	07-02-2002	CZ	20002812 A3	13-03-2002
			AU	7835401 A	13-02-2002
			WO	0210519 A1	07-02-2002
			EP	1307618 A1	07-05-2003
			SI	21103 A	30-06-2003
US 6364571	B1	02-04-2002	CA	2245111 A1	22-03-1999
			US	6481928 B1	19-11-2002
GB 2373807	A	02-10-2002	NONE		
CA 2320009	A	24-12-2000	CA	2320009 A1	24-12-2000
US 5298175	A	29-03-1994	US	5087152 A	11-02-1992
			US	5190238 A	02-03-1993
			US	5143479 A	01-09-1992
			US	5201607 A	13-04-1993
			US	5253953 A	19-10-1993
US 5865564	A	02-02-1999	NONE		
US 5040919	A	20-08-1991	NONE		

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82