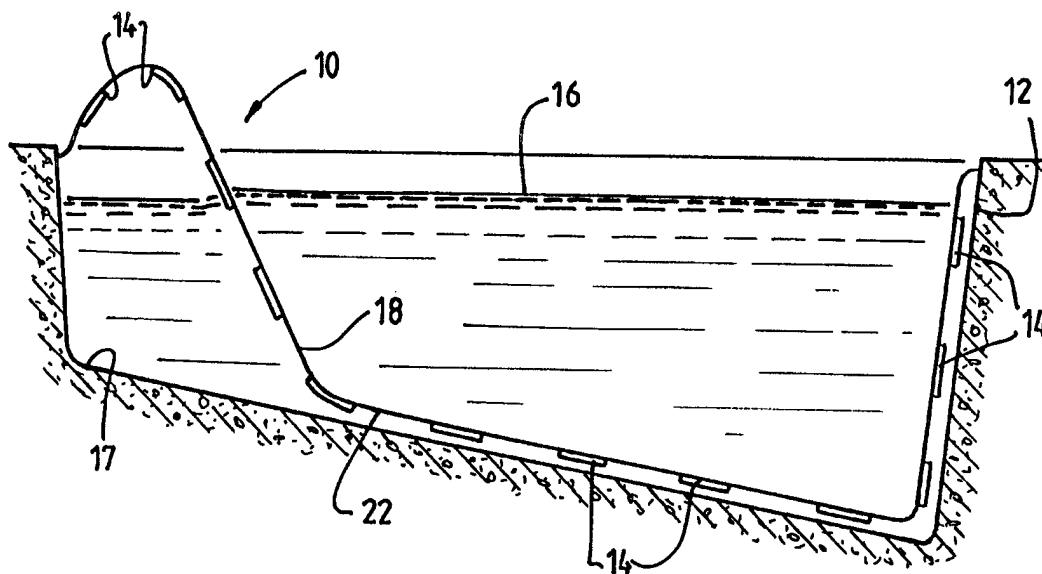




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(54) Title: A LINER FOR A FLUID BEARING RECEPTACLE



(57) Abstract

A liner (10) for a pool (12) is provided with a plurality of one way valves (14) to selectively allow water to flow from an upper side (18) of the liner to below a lower side (20). The valves (14) open automatically upon initial lifting of the liner (14) by use of an air lift system (36). As the liner (10) is lifted from the surface (17) of the pool (12) a pressure head is created which forces the valves (14) open while they are disposed in the water (16). The valves (14) include a resiliently biased flap (24) which is forced open by the pressure head. However when the valves (14) are lifted above the level of the water they automatically shut by combination of the biasing of the flaps (24) and the absence of the pressure differential.

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Title

A LINER FOR A FLUID BEARING RECEPTACLE

Field of the Invention

5 The present invention relates to a liner for a fluid bearing receptacle such as a swimming pool, chemical storage tank, dam, etc.

Background of the Invention

10 The Applicant's earlier patent application number PCT/AU97/00891, the contents of which is incorporated herein by way of reference, describes a liftable liner system for a fluid bearing receptacle. In broad terms, the system comprises a flexible liner which is shaped to conform with the inside surface of a receptacle such as a swimming pool; and, a baffle which is located between an
15 inside surface of the receptacle and the liner to form a spillway. By pumping the air between the liner and the inside surface of the swimming pool, the liner lifts away from the inside surface of the swimming pool and thus displace water to flow over the spillway underneath the
20 liner. In this way, the whole of the contents of the pool on top of the liner can be displaced to be beneath the liner. Thus in effect, the liner is lifted from the bottom of the pool to overlies the pool. To return the liner to a position in which it lines the inside surface of the
25 swimming pool, air is pumped into the spillway. The air, as it rises, lifts the water up the spillway and back onto the upper surface of the liner.

30 Trials conducted to date confirm that the system described in Applicant's application number PCT/AU97/00891, functions very well. The present invention was developed to further enhance the performance of the system described in application number PCT/AU97/00891. More particularly, the

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present invention was developed to increase the speed of the raising of the liner.

Summary of the Invention

According to a first aspect of the present invention there is provided a liner for lining the surface of a fluid bearing receptacle, said liner provided with one or more one way valves for controlling the flow of fluid between opposite sides of said liner, each one way valve arranged to allow fluid to flow in a direction from above said liner to below said liner and to substantially prevent flow of fluid from below said liner to above said liner.

Preferably said valve includes an aperture formed in said liner and a gate, said gate movable between a first position in which it covers and substantially seals said aperture and a second position in which said gate is spaced from said aperture to allow a flow of fluid therethrough.

Preferably said valve further includes bias means for biasing said gate toward said first position.

In one embodiment said bias means further acts to effectively couple said gate to said liner.

In an alternate embodiment said gate is in the form of a flap of material underlying said aperture and extending beyond the periphery of said aperture, a first length of the periphery of said flap being fixed to said liner and a second length of the periphery of the flap being free so that it can move away from said liner to allow fluid to flow from above said liner through said aperture to below said liner.

Preferably said bias means includes a strip or sheet of elastic material extending beneath and across at least a

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portion of said second length of said periphery of said flap.

5 Preferably said valve further includes filter means extending across said aperture to filter fluid as it passes therethrough.

10 Preferably said liner further includes sealing means disposed on one or both of: the periphery of said flap; and, on said liner about the periphery of said aperture; to assist in sealing said aperture when said liner is in contact with said surface of said receptacle and a fluid bears on an upper surface of said liner.

Preferably said liner further includes means for selectively moving said gate between said first and second positions.

15 According to another aspect of the present invention there is provided a system for raising and lowering a liner of a fluid bearing receptacle, said liner being in accordance with the first aspect of the invention and attached along its peripheral edge to said receptacle, said system
20 including:

baffle means adapted for connection to said receptacle in a manner so as to form a spillway which provides fluid communication between a lower side of said liner and an inside surface of said receptacle, said liner
25 being detached from said receptacle in the region of said baffle means and reattached along its peripheral edge to an upper edge of said baffle means;
first conduit for supplying a gas to the lower side of said liner; and,
30 second conduit for supplying a gas to said spillway;
whereby, in use, when a fluid is held within said receptacle on an upper side of said liner so as to hold said liner in a lining position with its lower

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side in contact with the inside surface of said receptacle and said baffle means, a gas can be passed through said first conduit to progressively lift said liner up and away from the inside surface of said receptacle thereby: displacing fluid held on the inside surface of said liner to flow over the upper edge of said baffle means down said spillway and between the outside surface of said liner and the inside surface of said receptacle; and causing said one or more one way valves to open to facilitate a further flow of fluid through the valves from above the liner to below the liner until substantially all of said fluid is so displaced, raising said liner to a covering position in which it covers said fluid, and a gas can be passed through said second conduit to lift said fluid up said spillway and over said upper edge of said baffle means onto the upper side of said liner progressively lowering said liner back to said lining position.

Brief Description of the Drawings

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

Figure 1 is a sectional view from the side of an embodiment of the present liner in use in a swimming pool;

Figure 2 is an enlarged cross section of a portion of a first embodiment of the liner shown in Figure 1;

Figure 3 is a plan view of the portion of the liner shown in Figure 2;

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Figure 4 is a cross section of a portion of a second embodiment of the liner with its valve in a closed position;

Figure 5 is a cross section of a portion of a second embodiment of the liner with its valve in an open position;

Figure 6 is a plan view of the portion of the liner shown in Figures 4 and 5;

Figure 7 is a partial section view of a system used for revising and lowering the liner;

Figure 8 is a front perspective view of a baffle plate used in the system shown in Figure 7;

Figure 9 is a back view of the plate shown in Figure 8; and,

Figure 10 is a plan view of a swimming pool incorporating a liner in accordance with the present invention and the system shown in Figure 7.

Detailed Description of The Preferred Embodiments

Referring to Figures 1 to 3 of the accompanying drawings, it can be seen that a first embodiment of a liner 10 for a fluid bearing receptacle such as a swimming pool 12 is provided with at least one (in this case a plurality) of valves 14. The liner 10 is shown in Figure 1 in a semi-raised position. The raising and lowering of the liner 10 is achieved by use of the system as described in international application number PCT/AU97/00891. A brief description of the system which enables the liner 10 to be lifted and lowered will be described later in this

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specification. Nevertheless, as previously mentioned a full description of the system for raising and lowering liner 10 is provided in international application number PCT/AU97/00891 the contents of which is incorporated herein by way of reference.

The valve 14 is a one way valve to allow the flow of fluid such as water 16 to flow from above the liner (ie. from an upper side 18 of the liner) to below the liner (ie. to a lower side 20). The purpose of this is to speed up the lifting of the liner from a position in which it lines inside surface 17 of the pool 12 to a position which it overlies the upper surface of the water 16. The displacement of water 16 from above the upper surface 18 to below the lower side 20 is achieved by causing the water 16 to flow through a spillway. The incorporation of one or more valves 14 speeds this up as the water is able to flow directly through the valves 14 from above to below the liner.

As shown perhaps most clearly in Figures 2 and 3, the valve 14 comprises an aperture 22 formed in the liner 10 with an underlying gate in the form of a flap 24. The flap 24 is dimensioned so as to wholly cover the aperture 22. A first length A B C D of the periphery of the flap 24 is fixed to the underside 20 of the liner about a portion of the aperture 22. This fixing can be done for example by forming a weld 26 along the length A B C D when the liner 10 and flap 24 is made of a plastic material. A second length A F E D of the periphery of the flap 24 remains free so that it can move away from the lower side 20 so as to allow water 16 to flow through the aperture 22.

Biasing means in the form of a strip or sheet of resilient material 28 is attached to the lower side 20 of the liner 10 across the flap 24 so as to bias the flap into a first position in which it substantially seals the aperture 22.

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The resilient strap or sheet 28 can overlies the entirety of the flap 24 or merely extend across the whole or a portion of the periphery A F E D of the flap 24.

5 A filter means in the form of a piece of meshing 30 is provided in the aperture 22 to filter the water 16 as it passes through the valve 14. This prevents the passage of any bodies of the size greater than the mesh size of meshing 30 from passing below the liner 10. For example, if the liner 10 were applied in a commercial fishing pond or tank, the meshing 30 would prevent the crop from passing
10 beneath the liner 10.

In order to assist in the sealing of the valve 14, a sealing strip 32 is provided on either the flap 24 or the lower side 20 of the liner 10 along or inboard a line
15 defined by the peripheral length A F E D of the flap 24. When the valve 14 is closed, the sealing strip 32 can assist in preventing the seepage or leakage of any water 16 from above the upper side 18 to below the lower side 20 of the liner 10.

20 A second embodiment of the liner 10 is shown in Figures 4 to 6. In these figures like reference numbers are used to designate like features. The main differences between the first and second embodiments are as follows. In the second embodiment the flap or gate 24 is not welded or otherwise
25 directly fixed to the liner 10. Rather the flap 24 is coupled to the liner 10 by a length of resilient material 28 which is connected between the liner 10 and the flap 24 along three sides A-B; B-C; and C-D of the flap 24. The outermost edge of the length of resilient material 28 is
30 attached by weld 26 to undersurface 20 of the liner 10. Another difference between the embodiments is that in the second embodiment shown in Figures 4 to 6, the sealing strip 32 extends completely about the aperture 22. In all other respects the first and second embodiments are alike

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and function in substantially the same way.

A system 36 for raising and lowering the liner 10 is depicted in Figures 7 to 10.

5 The system 36 for raising and lowering the liner 10 of swimming pool 12 includes a baffle in the form of a plate 38 used to define a spill away 40 for providing fluid communication between lower side 20 of the liner 10 and an inside surface 17 of the pool 12. Upper edge 44 of the
10 liner 10 is attached along and near an upper edge of surface of the pool 12 (except in the region behind the plate 38) and along upper edge 46 of the plate 38 using a conventional locking strip 48. Conduit 50 has a length 50' which extends along back face 52 of plate 38 below the upper edge 46. Holes or slots 54 cut in the plate 38
15 provide communication with length 50'. Conduit 56 having a length 56' extends across the back face 52 near its lower edge 58 to provide air to the spill way 40. The length 56' is provided with a number of holes 60 for admitting air into the spill way 40. In order to lift the liner 10, air
20 is directed through conduits 50, 50' to between lower side 20 of liner 10 and inside surface 42 of pool 12 and/or front surface 62 of the plate 38. The air progressively lifts the liner 10 up and away from the inside surface 42 displacing water held within the pool 12 to flow over upper
25 edge 46 into the spill way 40 so that the water now lies beneath the lower side 20. In this way the liner 10 is progressively raised to eventually lie above the level of the water. To return liner 10 to its lining position air is passed through conduits 56, 56' into spillway 40. As
30 the air rises it carries water up the spillway 40 and over the upper edge 46 onto the inside surface of liner 10 to progressively sink the liner 10 back to its lining position.

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The operation of the first embodiment of liner 10 will now be described with reference to Figures 1 to 3.

When the liner 10 is used with system 36, air is injected, via conduits 50, 50', between the inside surface 17 of the pool 12 and the lower side 20 of the liner 10. The air lifts the liner 10 from the surface 17 of the pool 12 displacing the water 16 to flow through spillway 40 to beneath the liner 10. From this time until the liner 10 is fully lifted to be above the water 16, the level of the water above the liner 10 is always greater than the level of the water below the liner 10. This creates a hydrostatic pressure difference or head acting across the valve 14 when the valve is submerged in the water 16 and not in contact with the pool surface 17. The hydrostatic pressure pushes the flap 24 away from the sealing strip 32 and lower side 20 of the liner 10 along length A F E D of its periphery against the bias of strap or sheet 28. This effectively opens the valve 10 so that water from above liner 10 can flow through aperture 22 to below the liner. Therefore, in addition to water passing from above the liner to below the liner through spillway 40, water is also able to pass beneath the liner 10 through any of the valves 14 which open due to the hydrostatic pressure difference between the upper side 18 and lower side 20 of the liner 10.

In the lifting process, a pocket of air 34 becomes entrapped between the lower side of the liner 20 and the surface of the water under the lower side 20. This pocket of air is at a pressure at least equal to, if not greater than, the ambient air pressure acting on the upper surface 18 of the liner 10 which is above the water level 16. As a result of this, the flap 24 is closed at least by the action of the resilient strip or sheet 28 if not also by the higher air pressure in the pocket 34 compared with the ambient pressure.

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Accordingly, once the valve 14 is raised above the level of the water 16 it is closed, preventing the air being injected between the lower side 20 and surface 17 of the pool 12 from escaping. Therefore the valves 14 do not interfere with the normal lifting operation of the liner 10.

By using the liner 10 with one or more valves 14, the liner 10 can be lifted substantially quicker than would otherwise occur by use of spillway 40 only as described in Applicant's international application number PCT/AU97/00891. This can be of substantial benefit if it is needed to retrieve something from the bottom of the pool very quickly or to quickly move the liner 10 from below to above the water 16 for example to prevent drowning. Additionally, it allows the use of lower capacity blowers, fans, or compressors to raise the liner 10.

The second embodiment of the liner 10 as depicted in Figures 4 to 6 operates in essentially the same manner as described above with reference to the first embodiment. The only substantial difference in operation is that in the second embodiment the whole of the flap 24 can be spaced from the undersurface 20 and sealing strip 32 when the valve 14 is open (refer Figure 5). In the first embodiment only the length AFED of the flap 24 can move away from the under surface 20 and sealing strip 32 to open the valve, (as the length ABCD is fixed to the undersurface 20).

Now that embodiments of the invention has been described in detail, it will be apparent to those skilled in the relevant arts that numerous modifications and variations may be made without departing from the basic inventive concepts. For example, the flap 24 can be attached to the lower side 20 of the liner 10 by any suitable means including the use of adhesives. Also, the length of the periphery of the flap 24 fixed to the lower side 20 may be

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greater than or less than that shown in Figure 3. Further, in a present embodiment, differences in either hydrostatic pressure or air pressure control the opening and shutting of the valve 14. However, it is envisaged that the valve
5 14 could include a driven actuator to selectively open and close the flap 24. For example, a hydraulic, pneumatic, electronic/magnetic device or system can be used to control the position of the gate or flap 24. Finally, the resilient strip or sheet 28 can be made of either a liquid
10 pervious or impervious material, however an impervious material is preferred, particularly for the second embodiment shown in Figures 4-6.

All such modifications and variations are deemed to be within the scope of the present invention the nature of
15 which is to be determined from the foregoing description and the appended claims.

The Claims Defining the Invention are as Follows:

1. A liner for lining the surface of a fluid bearing receptacle, said liner provided with one or more one way valves for controlling the flow of fluid between
5 opposite sides of said liner, each one way valve arranged to allow fluid to flow in a direction from above said liner to below said liner and to substantially prevent flow of fluid from below said liner to above said liner.
- 10 2. A liner according to claim 1 wherein, said valve includes an aperture formed in said liner and a gate, said gate movable between a first position in which it covers and substantially seals said aperture and a second position in which said gate is spaced from said
15 aperture to allow a flow of fluid therethrough.
3. A liner according to claim 2 wherein, said valve further includes bias means for biasing said gate toward said first position.
- 20 4. A liner according to claim 3 wherein, said bias means further acts to effectively couple said gate to said liner.
- 25 5. A liner according to claim 3 wherein, said gate is in the form of a flap of material underlying said aperture and extending beyond the periphery of said aperture, a first length of the periphery of said flap being fixed to said liner and a second length of the periphery of the flap being free so that it can move away from said liner to allow fluid to flow from above said liner through said aperture to below said liner.
- 30 6. A liner according to claim 5 wherein, said bias means includes a strip or sheet of elastic material

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extending beneath and across at least a portion of said second length of said periphery of said flap.

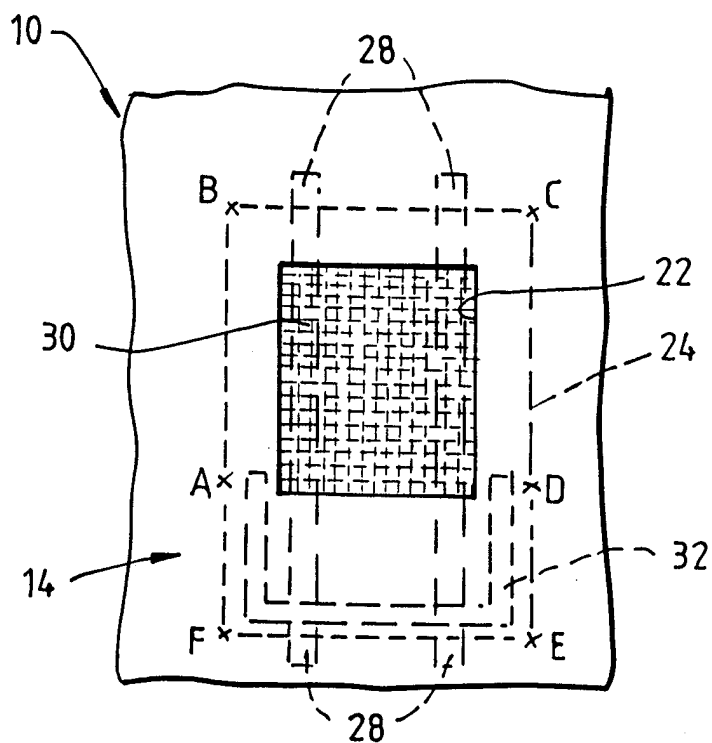
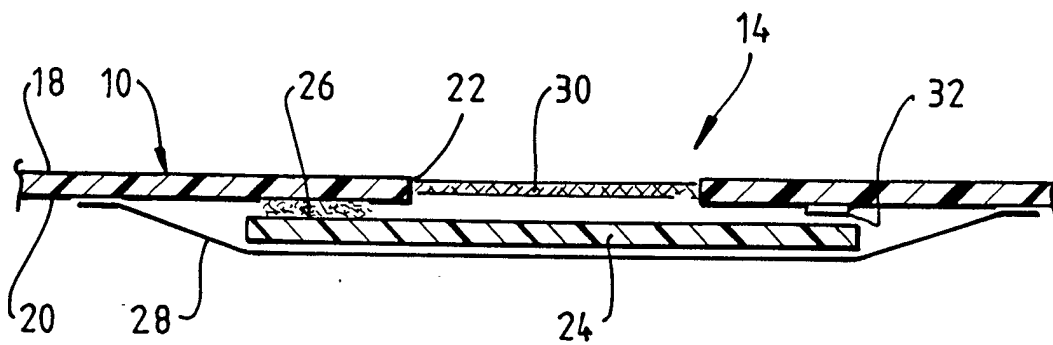
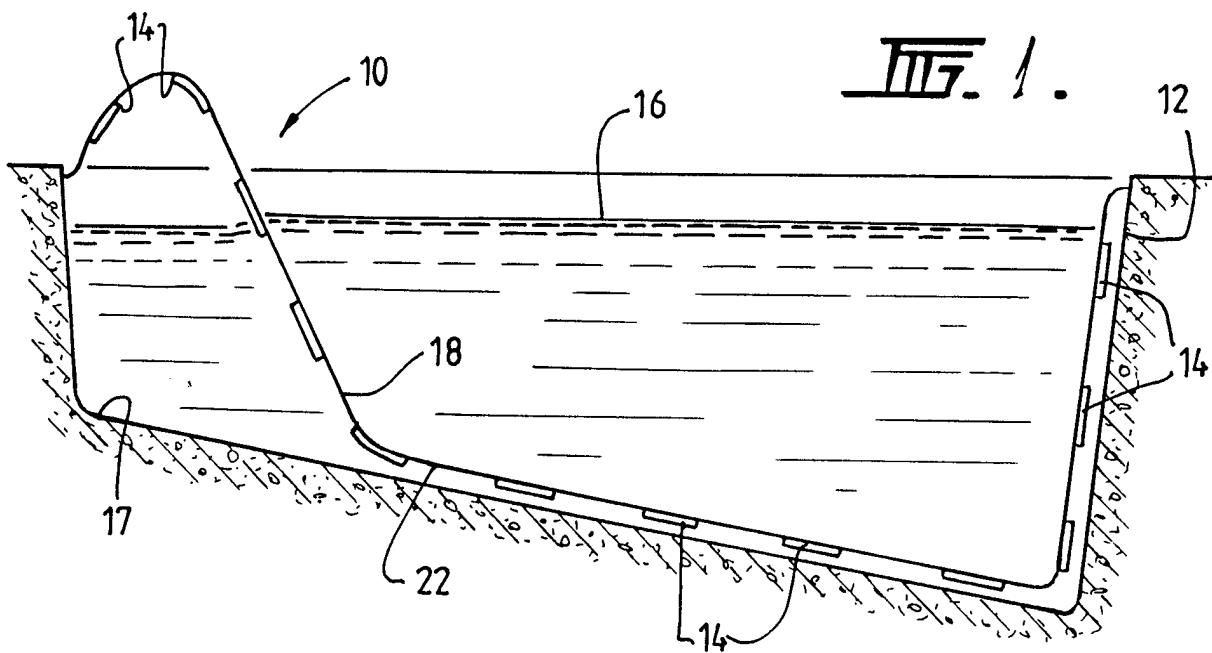
5 7. A liner according to claim 3 wherein, said valve further includes filter means extending across said aperture to filter fluid as it passes therethrough.

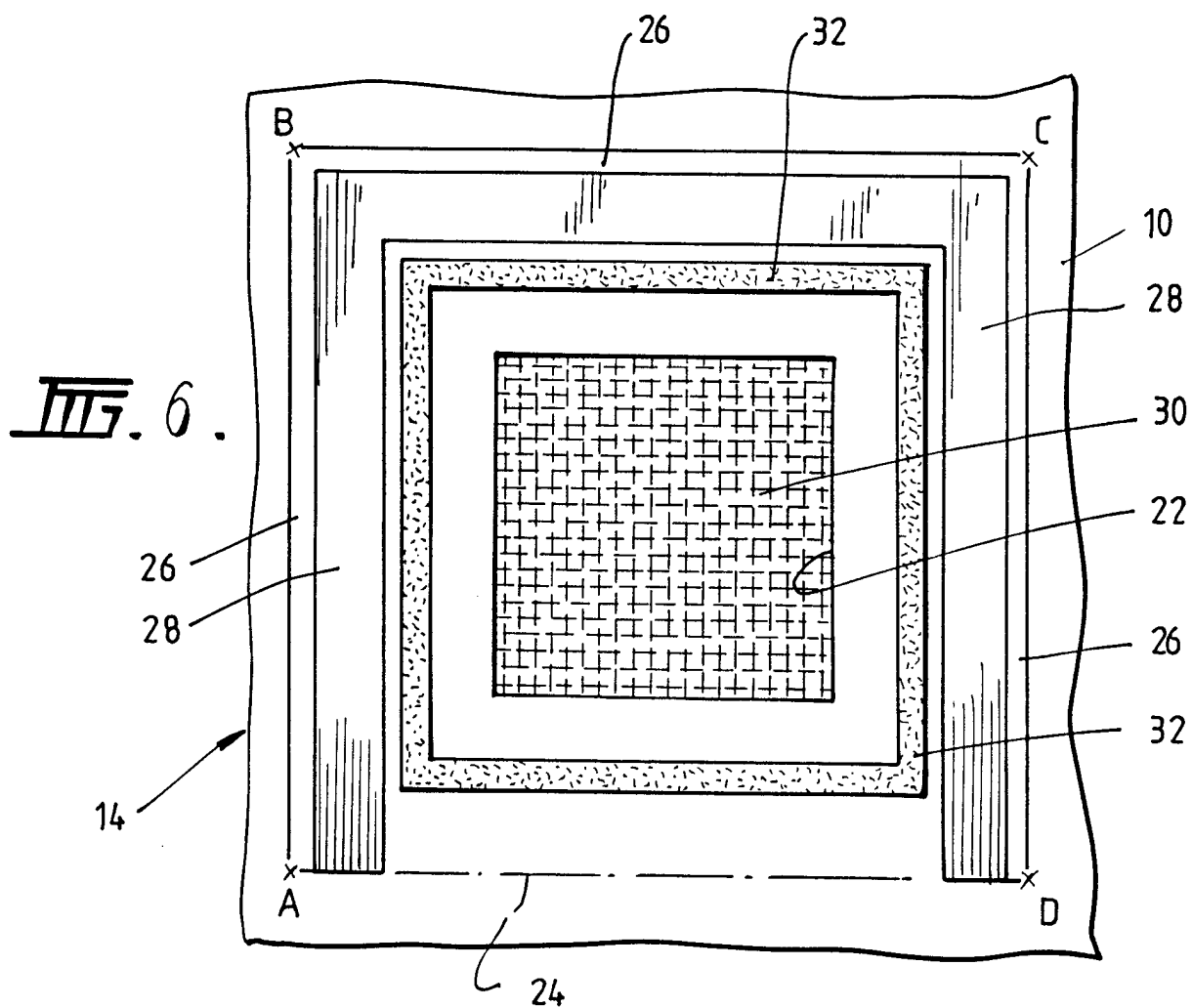
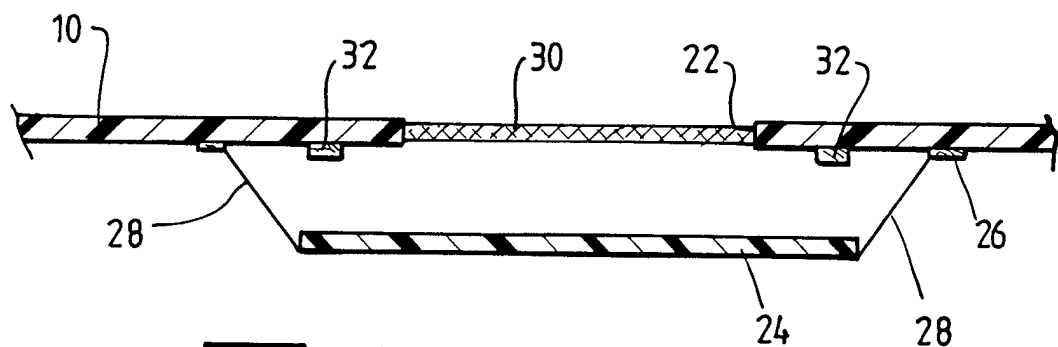
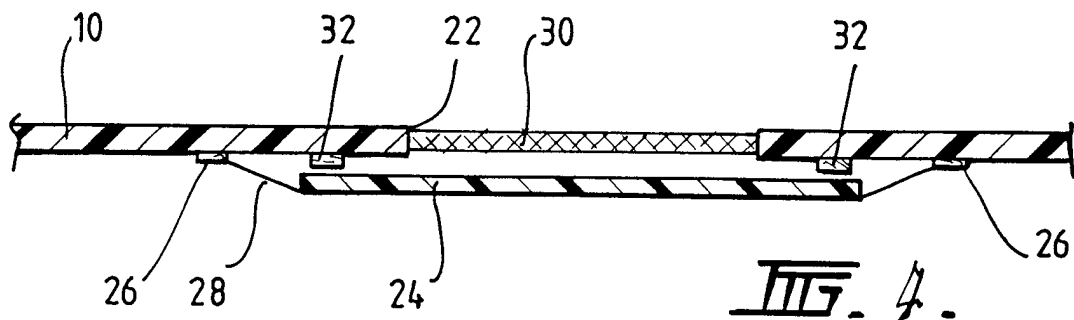
10 8. A liner according to claim 2 wherein, said liner further includes sealing means disposed on one or both of: the periphery of said flap; and, on said liner about the periphery of said aperture; to assist in sealing said aperture when said liner is in contact with said surface of said receptacle and a fluid bears on an upper surface of said liner.

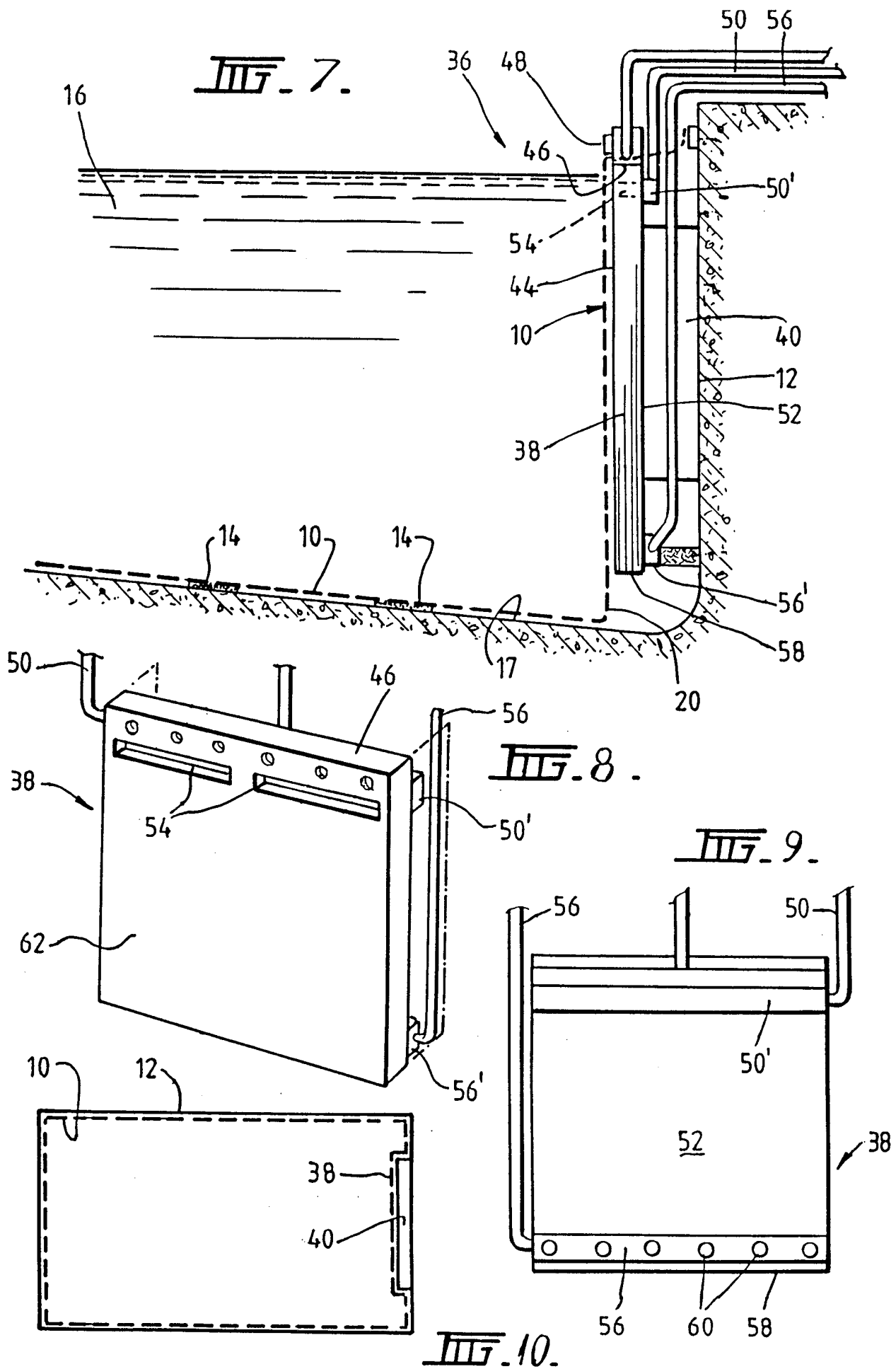
15 9. A system for raising and lowering a liner of a fluid bearing receptacle, said liner being in accordance with claim 1 and attached along its peripheral edge to said receptacle, said system including:
baffle means adapted for connection to said receptacle in a manner so as to form a spillway which provides fluid communication between a lower side of said liner and an inside surface of said receptacle, said liner being detached from said receptacle in the region of
20 said baffle means and reattached along its peripheral edge to an upper edge of said baffle means;
first conduit for supplying a gas to the lower side of
25 said liner; and,
second conduit for supplying a gas to said spillway;
whereby, in use, when a fluid is held within said receptacle on an upper side of said liner so as to hold said liner in a lining position with its lower
30 side in contact with the inside surface of said receptacle and said baffle means, a gas can be passed through said first conduit to progressively lift said liner up and away from the inside surface of said receptacle thereby: displacing fluid held on the

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inside surface of said liner to flow over the upper edge of said baffle means down said spillway and between the outside surface of said liner and the inside surface of said receptacle; and causing said one or more one way valves to open to facilitate a further flow of fluid through the valves from above the liner to below the liner until substantially all of said fluid is so displaced, raising said liner to a covering position in which it covers said fluid, and a gas can be passed through said second conduit to lift said fluid up said spillway and over said upper edge of said baffle means onto the upper side of said liner progressively lowering said liner back to said lining position.







INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 98/00232

A. CLASSIFICATION OF SUBJECT MATTER																						
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According to International Patent Classification (IPC) or to both national classification and IPC																						
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Minimum documentation searched (classification system followed by classification symbols) IPC EO4H 4/-, 3/-, B65D 88/-																						
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU IPC: EO4H 4/14, 4/10, B65D 88/34																						
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT & JAPIO + keywords (POOL, TANK#, DAM#, VAT, LINER#, LINING, COVER:, MEMBRANE, VALVE, GATE, FLAP.)																						
C. DOCUMENTS CONSIDERED TO BE RELEVANT																						
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																				
X	NL 8105926 A (MONSTER J A B V) 18 July 1983 whole document	1-8																				
A	US 3816859 A (MOSEHAUER) 18 June 1974.																					
A	US 4285078 A (BATSTONE) 25 August 1981 column 3, lines 7-11																					
A	Derwent Abstract Accession No. C9377C/13, class Q46, SW 7808540 (TUNESTAD KL) 10 March 1980																					
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"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art																			
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"P"	document published prior to the international filing date but later than the priority date claimed																					
Date of the actual completion of the international search 7 May 1998		Date of mailing of the international search report 22 MAY 1998																				
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929		Authorized officer GEOFF SADLIER Telephone No.: (02) 6283 2114																				

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

PCT/AU 98/00232

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
US	4285078	US	4236258

END OF ANNEX