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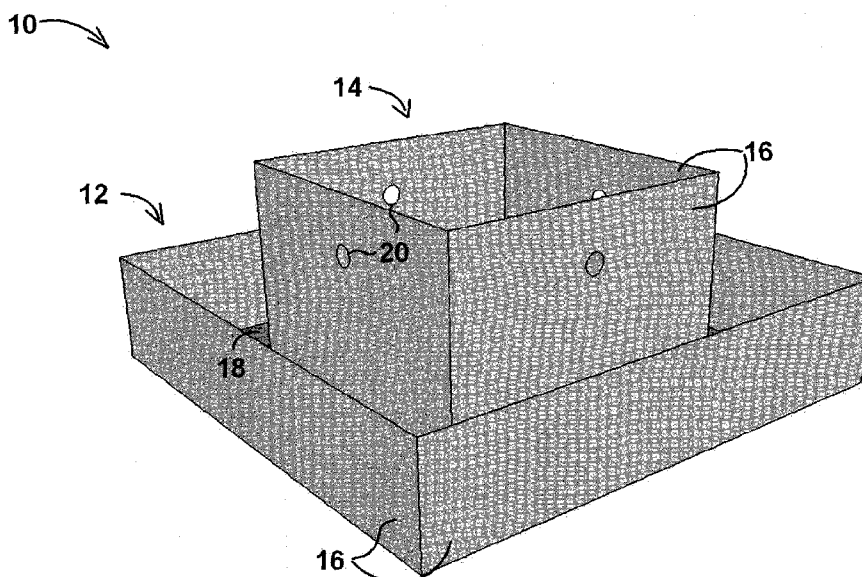
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(54) Title: DRILLING LIQUID SETTLING TANK



(57) Abstract: The invention provides a drilling liquid settling tank (10), a drilling liquid settling system, and a drilling liquid recycling method. The drilling liquid settling tank (10) includes an outer container (12) and an inner container (14). The inner container (14) is arranged within the outer container (12), and configured to receive a liquid, wherein the outer container is positioned and configured such that when the liquid overflows the inner container it is received within the outer container.



Title: Drilling Liquid Settling Tank**Technical field of the invention**

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This invention relates to drilling liquid settling tanks used in the exploration drilling or boring industry and a drilling liquid settling system and method for water management and recycling for drilling or boring operations.

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Background to the invention

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During drilling and other mine boring processes water and other chemicals are used to remove solid particles from drilling holes and also to cool the drilling or boring process to counteract the heat generated through friction. It is common practice to reuse and recycle this drilling chemical solution within a closed loop system in order to reduce the amount of waste water. It has further been established that the amount of solid particles contained within the solution correlates directly to drilling equipment longevity, with a clean solution, with no solid particles, providing the best results.

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The inventor has identified that the practice in current mine boring processes is to dig a combination of settling trenches and line these trenches with PVC plastic sheets. Water from the drilling process flows into these trenches where the solid particles settle, which leaves particle free water that can be recycled into the drilling process. Problems associated with these settling trenches is that they overflow regularly and are not robust, as the PVC plastic sheets are often ruptured, which can result in chemical contamination of the environment. In addition, the digging, cleaning and rehabilitation of the trenches are labour intensive and time consuming.

It is an object of the invention to provide a more robust alternative to current drilling water and chemical management in the drilling industry with particular attention to the prevention of damage to the environment.

General description of the invention

5 According to a first aspect of the invention there is provided a drilling liquid settling tank which settling tank includes:

an outer container; and

an inner container, arranged within the outer container, and configured to receive a liquid, wherein the outer container is positioned and configured such
10 that when the liquid overflows the inner container it is received within the outer container.

Both the inner container and the outer container may be in the form of quadrilateral or round basins each with a continuous side wall and a base. Both
15 containers may also be substantially cylindrical in shape. The base of the inner container is typically smaller than the base of the outer container. In a preferred embodiment of the invention the base of the inner container is arranged centrally on the base of the outer container. In order to provide an increased volume the sidewalls of the inner container typically project further upwards than the side
20 walls of the outer container.

The settling tank may include carrying means, preferably in the form of handles arranged on the outer container. It is to be appreciated that the settling tank can be moved from one drilling site to the next. The settling tank may be
25 shaped and configured to complementally fit onto another settling tank in order to facilitate packaging and transportation.

The inner container may be shaped to define apertures, which apertures may be configured to receive or attach to piping in order to regulate the flow of
30 the liquid, some of the apertures may be configured to be used as liquid inlets and other apertures may be configured to be used as liquid outlets or overflows. The liquid is typically a mixture of water and other chemicals used in a drilling process and the liquid usually contains rock, stone or other solid particles when flowing from a bore hole.

The inner container is typically used as a sump into which the drilling liquid mixture flows from the bore hole, with the outer container acting as a bund into which the sump overflows. Through regulating the speed of flow of water into and out of the sump the settling time for any contaminants within the drilling liquid can be determined. In typical working conditions the flow is such that the inner container does not overflow into the bund.

The inner container may be provided with a lid with an inspection opening and the settling tank may then be provided with a float provided with an indicator pole protruding through the inspection hole to indicate the water level in the inner container.

In use, the contaminated liquid from the borehole flows into the inner container or sump. The solid particles within the liquid settles to the bottom of the sump with the speed at which liquid flows into the sump typically determining the settling time, with a high flow resulting in increased settling periods. When the sump is full, relatively cleaner water is piped from the sump, with solid particles remaining in the sump. Typically the solid particles are intermittently cleared from the sump and in a preferred embodiment this is accomplished through the use of a plastic shovel, which is unlikely to damage any part of the settling tank. Water extracted from the sump can be resettled in a further sump, with each subsequent settling tank typically allowing for the removal of additional solid particles.

The inventor has observed that a multi stage settling process delivers a clearer liquid solution. A multi-stage settling process may be achieved through using multiple settling tanks, with the liquids from one inner container piped to the inner container of a further settling tank.

The settling tank may be manufactured from a suitable plastic or alternatively a fibreglass material.

According to a second aspect of the invention there is provided a drilling liquid settling system which includes:

at least two settling tanks, as described according to the first aspect of the invention, connected in series, wherein used contaminated drilling liquid from a drilling process flows to the inner container of the first settling tank, and so on to the next settling tank; and

a removable plastics reservoir configured to receive the overflow from the last settling tank, supernatant liquid, from which the liquid is recycled to the drilling process.

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The system may include an initial plastics sump similar to a settling tank as described earlier and positioned at the level of the outflow of the drilling liquid from the drilled hole, wherein the drilling liquid is first received and pumped upwards to the first settling tank. The sump receives most of the drill cuttings and mud and needs to be cleaned regularly.

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The last settling tank may be used as the reservoir for drilling liquid for the drilling operations and the reservoir may preferably be provided with a float and an indicator pole to indicate the liquid level.

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The system may further include a mixing tank for mixing unused drilling liquid to be introduced into the reservoir for drilling operations.

According to a third aspect of the invention there is provided a drilling liquid recycling method, which method includes the steps of:

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providing at least two settling tanks, as described according to the first aspect of the invention, connected in series, wherein used contaminated drilling liquid from a drilling process gravitates to the inner container of the first settling tank, and so on to the next settling tank; and

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providing a removable plastics reservoir configured to receive the overflow from the last settling tank, supernatant liquid, from which the liquid is recycled to the drilling process.

The method may include providing an initial plastics sump similar to a settling tank as described earlier and positioned at the level of the outflow of the drilling liquid from the drilled hole, wherein the drilling liquid is first received and pumping the liquid upwards to the first settling tank. The sump receives most of
5 the drill cuttings and mud and needs to be cleaned regularly.

The last settling tank may be used as a reservoir for drilling liquid for the drilling operations and the reservoir may preferably be provided with a float and an indicator pole protruding from the tank to indicate the liquid level. The method
10 includes the step of pumping the liquid from the reservoir to a drill rig.

The method may further include mixing unused drilling liquid in a mixing tank and introducing the unused drilling liquid into the reservoir for drilling operations as needed.
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The inventor believes that application of the invention can improve safety, productivity and especially environmental control.

Detailed description of the invention

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The invention is now described by way of example with reference to the accompanying drawings.

In the drawings:

25 Figure 1 shows a perspective plan view of a settling tank, in accordance with the invention;

Figure 2 shows a perspective side view of the settling tank;

Figure 3 shows a three-dimensional perspective view of the settling tank; and

Figure 4 shows schematically a drilling liquid settling system.
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Referring now to the drawings, the settling tank, in accordance with the invention, is generally indicated by reference numeral 10.

The settling tank 10 includes an outer container 12 and an inner container 14. The inner container 14 is arranged within the outer container 12, and is configured to receive a liquid (not shown). The outer container 12 is positioned and configured such that when the liquid (not shown) overflows the inner container 14 it is received within the outer container 12.

Both the inner container 14 and the outer container 12 are in the form of quadrilateral basins each with four side walls 16 and a base 18. The inner container 14 is arranged centrally on the base of the outer container 12, with the sidewalls of the inner container 14 being slightly longer so as to protrude from the outer container 12.

The inner container 14 is shaped to define apertures 20, which are configured to receive piping, allowing certain apertures 20 to be used as a liquid inlet and other apertures 20 to be used as overflow outlets.

The inner container 14 is typically used as a sump into which the drilling liquid mixture (not shown) flows from a bore hole, with the outer container 12 acting as a bund into which the sump can overflow in as a precautionary measure. In use, the contaminated liquid from the bore hole flows into the inner container 14 or sump. The solid particles (not shown) within the liquid (not shown) settles to the bottom of the sump with the speed at which liquid flows into the inner container 14 and other characteristics of the particles determining the settling time. When the inner container 14 is full, relatively cleaner water is piped to the inner container 14 of a second settling tank with a certain amount of the solid particles remaining in the first settling.

Referring now to Figure 4, a drilling liquid settling system is generally indicated by reference numeral 30. The system 30 includes four settling tanks 10, as described according to the first aspect of the invention, connected in series, wherein used contaminated drilling liquid from a drill rig 32 flows to the inner container of the first settling tank, and so on to the next settling tank.

The last settling tank 10.4 is in the form of a removable plastics reservoir configured to receive the overflow from the previous settling tank 10.3 from which the liquid is recycled to the drilling process. The last settling tank or reservoir 10.4 is provided with a float and an indicator pole to indicate the liquid level.

5

The system 30 further includes an initial plastics sump 34 similar to a settling tank as described earlier and positioned at the level of the outflow of the drilling liquid from the drilled hole, wherein the drilling liquid is first received and pumped upwards to the first settling tank 10.1. The sump receives most of the drill cuttings and mud and needs to be cleaned regularly with a plastics shovel to prevent damage to the plastics sump.

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The system further includes a mixing tank 36 for mixing unused drilling liquid to be introduced into the reservoir 10.4 for drilling operations.

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It shall be understood that the examples are provided for illustrating the invention further and to assist a person skilled in the art with understanding the invention and are not meant to be construed as unduly limiting the reasonable scope of the invention.

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CLAIMS

1. According to a first aspect of the invention there is provided drilling liquid settling tank which includes:

an outer container; and

5 an inner container, arranged within the outer container, and configured to receive a liquid, wherein the outer container is positioned and configured such that when the liquid overflows the inner container it is received within the outer container.

2. A settling tank as claimed in Claim 1, wherein the base of the inner
10 container is typically smaller than the base of the outer container arranged centrally on the base of the outer container with the sidewalls of the inner container projecting further upwards than the side walls of the outer container.

3. A settling tank as claimed in Claim 1 or Claim 2, wherein the inner
15 container is shaped to define apertures to receive or attach to piping to form an inlet, outlet and/or overflow.

4. A settling tank as claimed in any one of claims 1 to 3, wherein the
inner container is provided with a lid with an inspection opening and further
20 provided with a float provided with an indicator pole protruding through the inspection hole to indicate the liquid level in the inner container.

5. A drilling liquid settling system which includes:
at least two settling tanks, as claimed in any one of claims 1 to 4,
25 connected in series, wherein used contaminated drilling liquid from a drilling process flows to the inner container of the first settling tank, and so on to the next settling tank; and

a removable plastics reservoir configured to receive the overflow from the
last settling tank, supernatant liquid, from which the liquid is recycled to the
30 drilling process.

6. A system as claimed in Claim 5, which system includes an initial plastics sump positioned at the level of the outflow of the drilling liquid from the drilled hole, in use, wherein the drilling liquid is first received and pumped upwards to the first settling tank.

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7. A system as claimed in Claim 5 or Claim 6, wherein the last settling tank is used as the reservoir for drilling liquid for the drilling operations and the reservoir is provided with a float and an indicator pole to indicate the liquid level.

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8. A system as claimed in any one of claims 5 to 7, which includes a mixing tank for mixing unused drilling liquid to be introduced into the reservoir for drilling operations.

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9. A drilling liquid recycling method, which method includes the steps of:

providing at least two settling tanks, as claimed in any one of claims 1 to 4, connected in series, wherein used contaminated drilling liquid from a drilling process gravitates to the inner container of the first settling tank, and so on to the next settling tank; and

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providing a removable plastics reservoir configured to receive the overflow from the last settling tank, supernatant liquid, from which the liquid is recycled to the drilling process.

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10. A method as claimed in Claim 9, which includes the steps of providing an initial plastics sump positioned at the level of the outflow of the drilling liquid from the drilled hole, wherein the drilling liquid is first received and pumping the liquid upwards to the first settling tank.

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11. A method as claimed in Claim 9 or Claim 10, which includes the steps of using the last settling tank as a reservoir for drilling liquid for the drilling operations and the reservoir is provided with a float and an indicator pole to indicate the liquid level, and pumping the liquid from the reservoir to a drill rig.

12. A method as claimed in any one of claims 9 to 11, including the step of mixing unused drilling liquid in a mixing tank and introducing the unused drilling liquid into the reservoir for drilling operations as needed.

13. According to a first aspect of the invention there is provided drilling liquid settling tank substantially as described herein with reference to the accompanying drawings.

14. A drilling liquid settling system substantially as described herein with reference to the accompanying drawings.

15. A drilling liquid recycling method substantially as described herein with reference to the accompanying drawings.

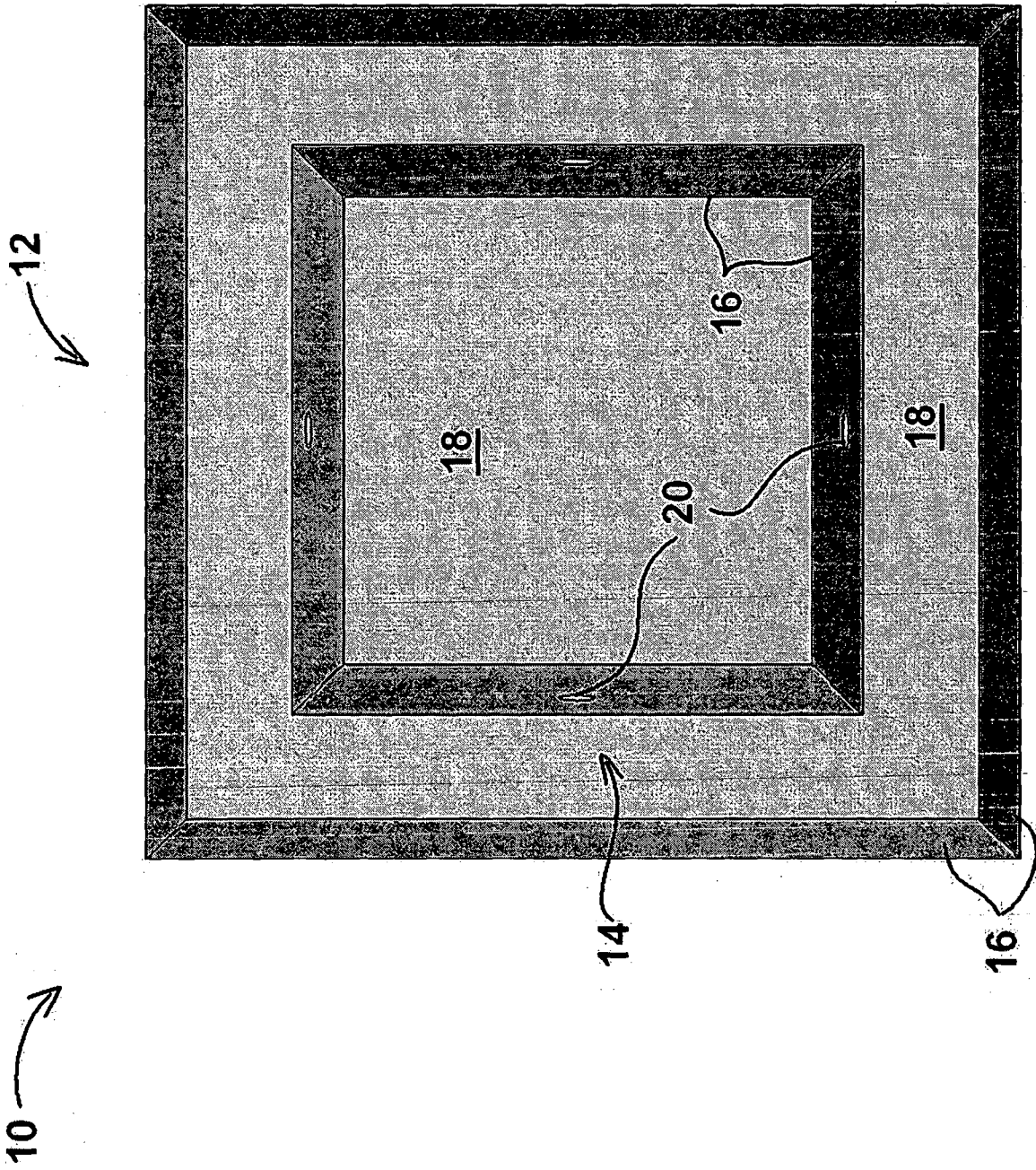


Figure 1

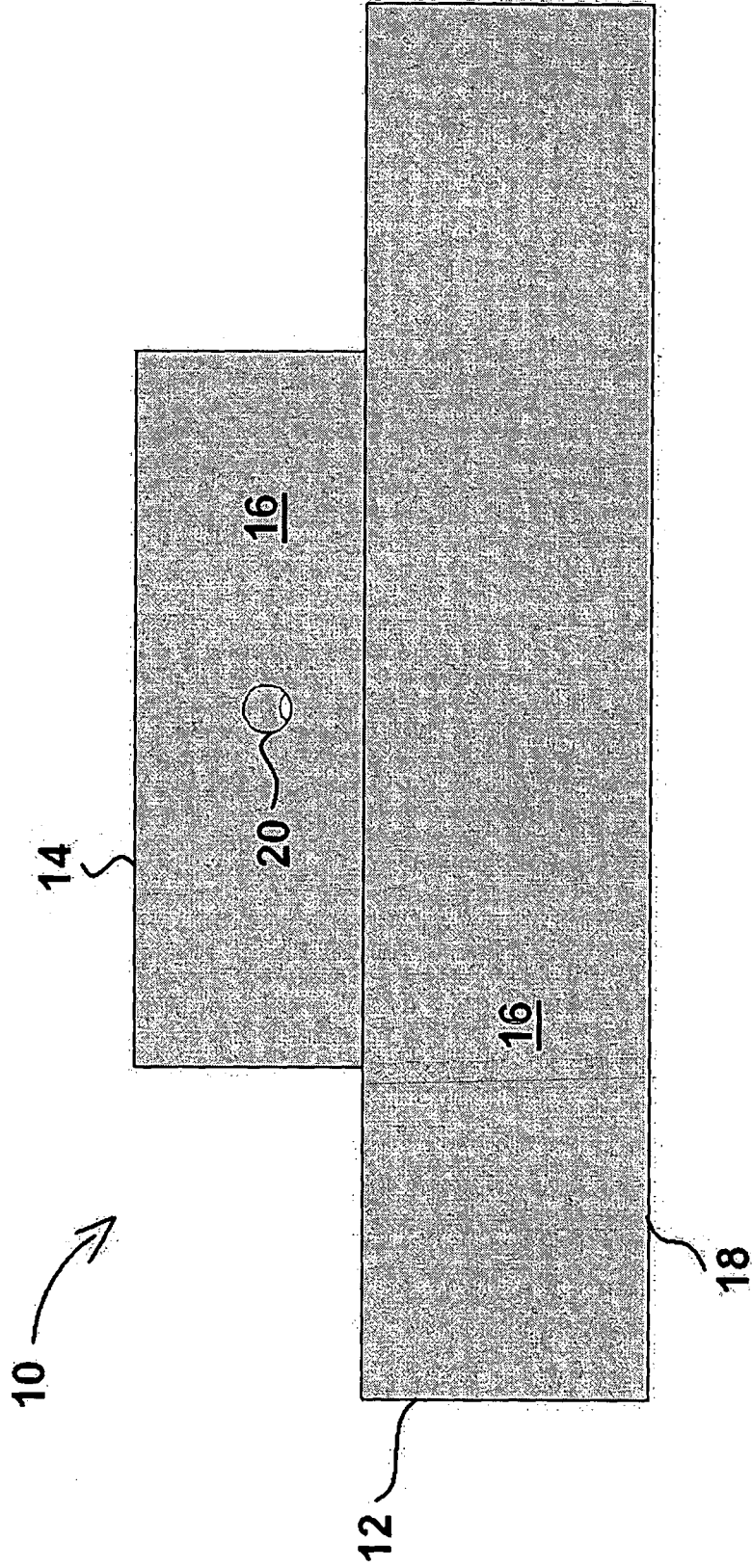


Figure 2

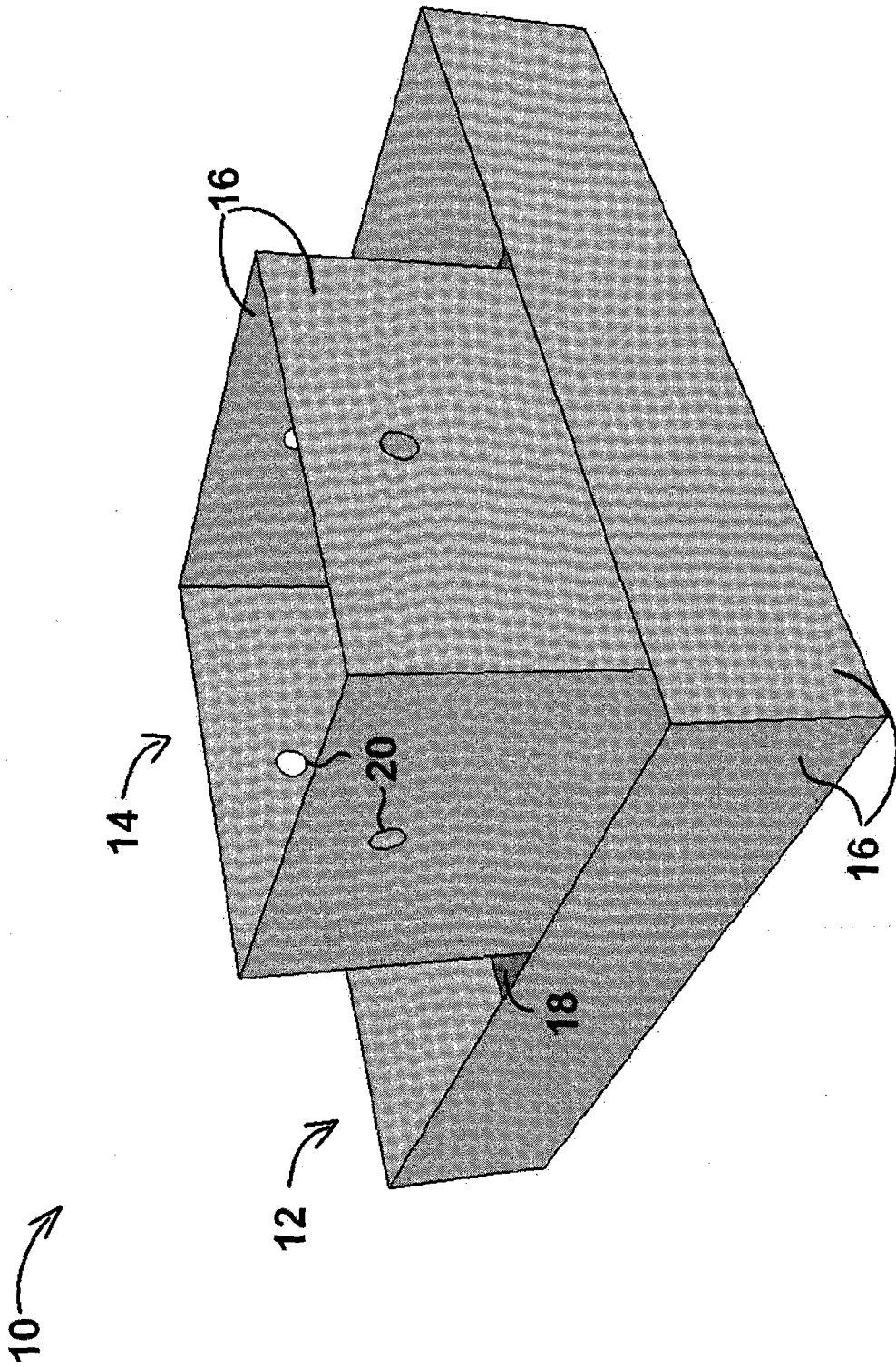


Figure 3

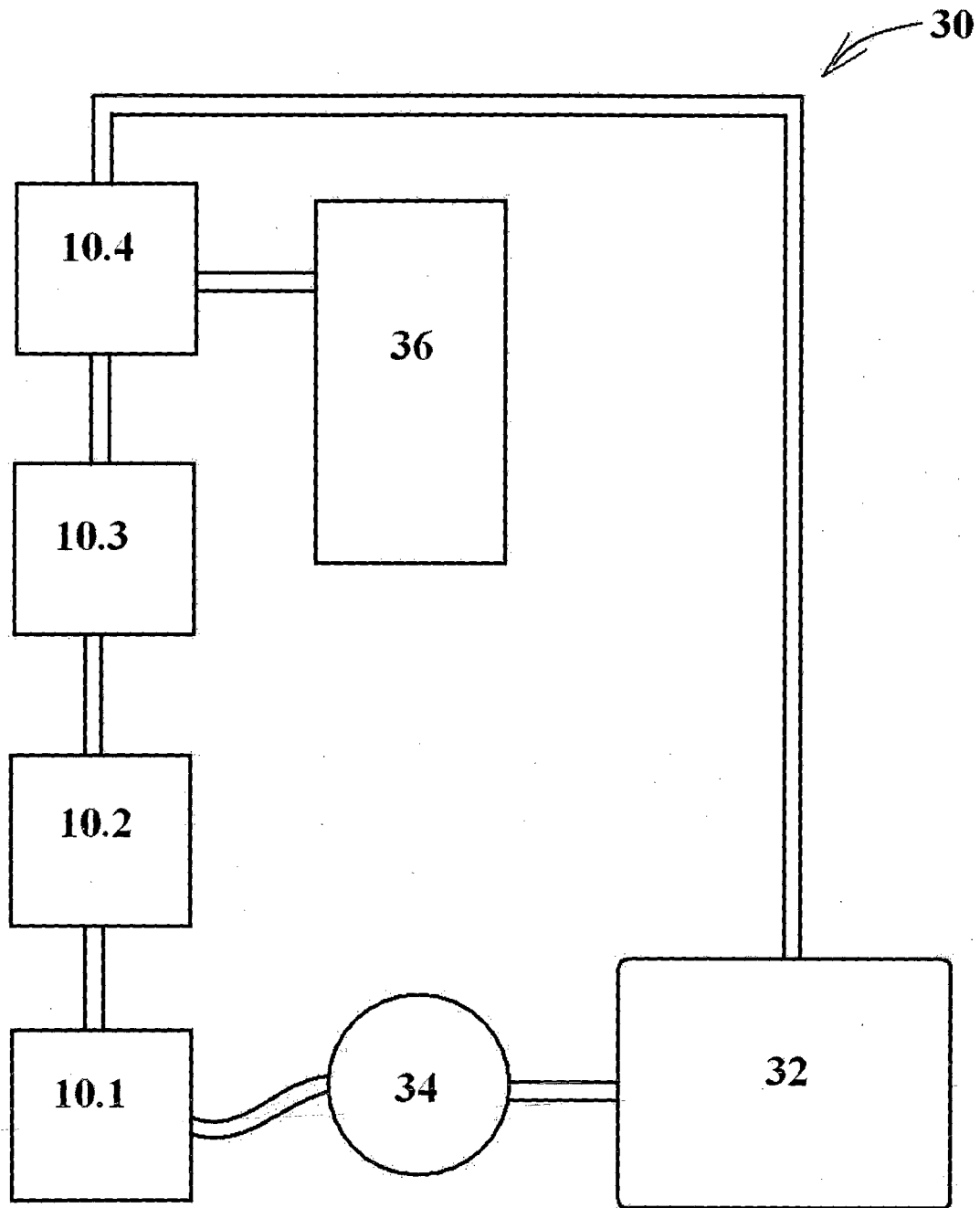


Figure 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT / ZA 2013/000027

A. CLASSIFICATION OF SUBJECT MATTER IPC: B01D 21/02 (2006.01) According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) B01D Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPI, EPODOC, PAJ, Espacenet, internet		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6193070 B1 (ROWNEY et al.) 27 February 2001 (27.02.2001) Claim 1, abstract, figure 1	1-12
A	US 2006086676 A1 (SMITH et al.) 27 April 2006 (27.04.2006) Claims 1 and 38, figure 16	1-12
A	US 2006096935 A1 (HARDING et al.) 11 May 2006 (11.05.2006) Claim 1 and figure 1	1-12
A	US 2010264093 A1 (RALPH et al.) 21 October 2010 (21.10.2010) Claim 1, abstract	1-12
A	US 2011247804 A1 (WOOLSEY GARY) 13 October 2011 (13.10.2011) Claim 1, figure 6	1-12
<input checked="" type="checkbox"/>	Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.
* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date		"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
"O" document referring to an oral disclosure, use, exhibition or other means		"&" document member of the same patent family
"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 05 August 2013 (05.08.2013)	Date of mailing of the international search report 12 August 2013 (12.08.2013)	
Name and mailing address of the ISA/AT Austrian Patent Office Dresdner Straße 87, A-1200 Vienna Facsimile No. +43 / 1 / 534 24-535	Authorized officer STEPANOVSKY M. Telephone No. +43 / 1 / 534 24-135	

INTERNATIONAL SEARCH REPORT

International application No.

PCT / ZA 2013/000027

Box No. II	Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)
<p>This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:</p> <p>1. <input type="checkbox"/> Claims Nos.:</p> <p style="padding-left: 20px;">because they relate to subject matter not required to be searched by this Authority, namely:</p> <p>2. <input checked="" type="checkbox"/> Claims Nos.: 13-15</p> <p style="padding-left: 20px;">because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:</p> <p>These claims do not contain any technical details or rules. They only refer to the figures .</p> <p>3. <input type="checkbox"/> Claims Nos.:</p> <p style="padding-left: 20px;">because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).</p>	
Box No. III	Observations where unity of invention is lacking (Continuation of item 3 of first sheet)
<p>This International Searching Authority found multiple inventions in this international application, as follows:</p> <p>1. <input type="checkbox"/> As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.</p> <p>2. <input type="checkbox"/> As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.</p> <p>3. <input type="checkbox"/> As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:</p> <p>4. <input type="checkbox"/> No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:</p>	
<p>Remark on Protest</p> <p><input type="checkbox"/> The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.</p> <p><input type="checkbox"/> The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.</p> <p><input type="checkbox"/> No protest accompanied the payment of additional search fees.</p>	

INTERNATIONAL SEARCH REPORT

International application No.

PCT / ZA 2013/000027

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 102004015779 A1 (DIPL.-ING. ERICH FETZER GMBH & CO) 28 October 2004 (28.10.2004) Claims, figure 2 0	1-12

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT / ZA 2013/000027

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US	B1	6193070	US	A	6059977	2000-05-09
			US	B1	6193070	2001-02-27
			CA	A1	2219053	1997-11-22
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US	A1	2010264093	US	A1	2008251465	2008-10-16
			US	A1	2010264093	2010-10-21
			CA	A1	2608798	2008-10-16
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			AU	A1	2009330223	2011-07-28
			MX	A	2011006876	2011-07-20
			EP	A2	2379240	2011-10-26
			WO	A2	2010075193	2010-07-01
			EA	A1	201170891	2012-01-30
			CA	A1	2748094	2010-07-01
DE	A1	102004015779	DE	U1	20305700	2003-07-31
			DE	A1	102004015779	2004-10-28