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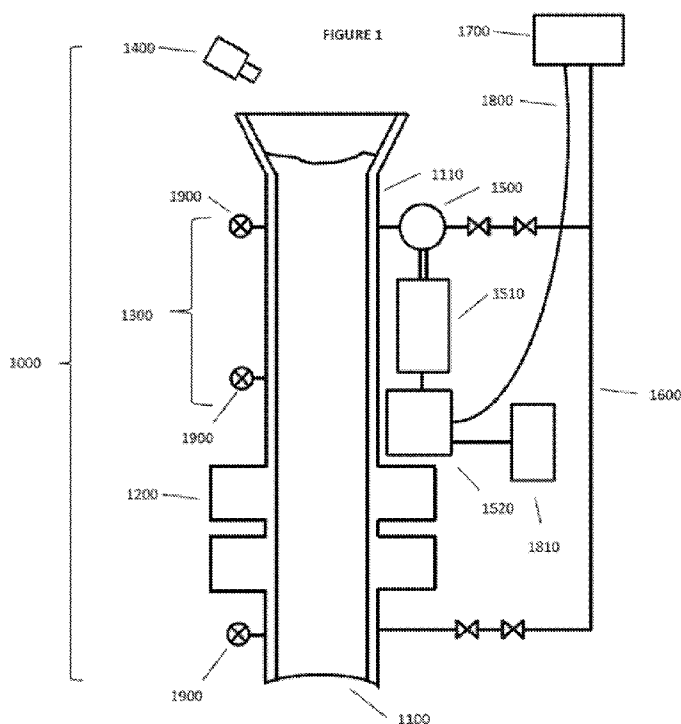
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[Continued on next page]

(54) Title: NON-OBTRUSIVE METHODS OF MEASURING FLOWS INTO AND OUT OF A SUBSEA WELL AND ASSOCIATED SYSTEMS



(57) Abstract: A fluid level monitoring system comprising: a subsea well comprising a wellbore and a wellhead; a subsea well isolation device installed on the wellhead; and a fluid level monitoring device and associated methods.



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LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE,
SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
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NON-OBTRUSIVE METHODS OF MEASURING FLOWS INTO AND OUT OF A SUBSEA WELL AND ASSOCIATED SYSTEMS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No.
5 62/127,134, filed March 2, 2015, which is incorporated herein by reference.

BACKGROUND

[0002] The present disclosure relates generally to methods of measuring flows into
and out of subsea wells. More specifically, in certain embodiments, the present disclosure
relates to non-obtrusive methods of measuring flows into and out of subsea wells and
10 associated systems.

[0003] In order to provide adequate well control and to satisfy the statutory safety
requirements of many jurisdictions around the world, most operating companies adopt the
principle of ensuring that at least two independently verified barriers are in place at all
times during the construction or suspension of wells. Conventional methods of suspending
15 the well may involve the use of a Mobile Offshore Drilling Unit (MODU) to install
completions through a marine riser and subsea blowout preventer (BOP) conduit.
Typically these conventional methods require an enclosed conduit between the wellhead
and the deployment unit to maintain primary well control and monitor fluid levels in the
wellbore. Using these methods may require the MODU on-site throughout the completion
20 installation or well suspension period when it could be better utilized drilling wells or
performing other operations.

[0004] Other methods of suspending a well are discussed in U.S. Patent No.
7,438,135, the entirety of which is hereby incorporated by reference. Briefly, U. S. Patent
No. 7,438,135 describes method of suspending a well that do not require the use of a BOP
25 stack to supplement well control. Disadvantages of such method are that the barrier
systems described therein may not be suitable for use in open water environments. In
addition, the methods described therein include intensive high risk wireline operations to
install and verify the barriers with no means to isolate the wellbore at the mudline in the
event of downhole failure.

30 [0005] Improved methods of suspending, completing, and/or working over a well
are described in PCT/US2014/058786, the entirety of which is hereby incorporated by
reference. Briefly, the methods and systems described therein utilize a subsea well
isolation device that removes the need of using a riser. In typical riser systems, a trip tank

is used to provide a monitoring mechanism that records volume gains/losses during well operations. However, in riserless systems, such a trip tank does not exist.

[0006] It is desirable to develop a method of measuring flows into and out of subsea wells in riserless systems.

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SUMMARY

[0007] The present disclosure relates generally to methods of measuring flows into and out of subsea wells. More specifically, in certain embodiments, the present disclosure relates to non-obtrusive methods of measuring flows into and out of subsea wells and associated systems.

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[0008] In one embodiment, the present disclosure provides a fluid level monitoring system comprising: a subsea well comprising a wellbore and a wellhead, a subsea well isolation device installed on the wellhead, and a fluid level monitoring device.

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[0009] In another embodiment, the present disclosure provides a method of maintaining a constant fluid level within a wellbore comprising: providing a fluid level monitoring system comprising a subsea well comprising a wellbore and a wellhead, a subsea well isolation device installed on the wellhead, and a fluid level monitoring device and maintaining a constant fluid level within the wellbore.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] A more complete and thorough understanding of the present embodiments and advantages thereof may be acquired by referring to the following description taken in conjunction with the accompanying drawings.

20

[0011] Figure 1 is an illustration of a fluid level monitoring system in accordance with certain embodiments of the present disclosure.

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[0012] Figure 2 is an illustration of a fluid level monitoring system in accordance with certain embodiments of the present disclosure.

[0013] Figure 3 is an illustration of a fluid level monitoring system in accordance with certain embodiments of the present disclosure.

30

[0014] The features and advantages of the present disclosure will be readily apparent to those skilled in the art. While numerous changes may be made by those skilled in the art, such changes are within the spirit of the disclosure.

DETAILED DESCRIPTION

[0015] The description that follows includes exemplary apparatuses, methods, techniques, and/or instruction sequences that embody techniques of the inventive subject

matter. However, it is understood that the described embodiments may be practiced without these specific details.

[0016] The present disclosure relates generally to methods of measuring flows into and out of subsea wells. More specifically, in certain embodiments, the present disclosure
5 relates to non-obtrusive methods of measuring flows into and out of subsea wells and associated systems.

[0017] In certain embodiments, the present disclosure provides a system that is capable of monitoring the fluid level in a subsea well during well service operations when in a riserless operational mode.

10 [0018] There may be several advantages of the methods and systems described herein. In certain embodiments, the methods and systems described herein may provide a system with the capability to monitor subsea wellbore fluid level and the condition of the well barriers required to maintain well control in riserless systems. In certain embodiments, the methods and systems described herein may provide an early warning in order to
15 implement secondary well control measures in the event of a failure of a primary well barrier in riserless systems.

[0019] Referring now to Figure 1, Figure 1 illustrates a fluid level monitoring system 1000. In certain embodiments, fluid level monitoring system 1000 may comprise subsea well 1100 and subsea well isolation device 1200.

20 [0020] In certain embodiments, subsea well 1100 may comprise any type of subsea well. In certain embodiments, subsea well 1100 may be in a riserless operation mode. As used herein, the term riserless operation mode refers to a mode where operations are conducted directly through seawater on a subsea well without the use of a riser conduit to the surface operation unit. In such embodiments, subsea well isolation device 1200 may be
25 installed on wellhead 1110 of subsea well 1100. In certain embodiments, subsea well isolation device 1200 may be used to provide well control and fluid management to subsea well 1100. Examples of suitable subsea well isolation devices are described in PCT/US2014/058786, the entirety of which is hereby incorporation by reference.

[0021] In certain embodiments, subsea well 1100 may be undergoing a well service
30 operation. In certain embodiments, subsea well 1100 may be undergoing a riserless operation. Examples of well service operations include, wireline well intervention, coiled tubing well intervention, jointed pipe well intervention, and completion tubing installation or replacement.

[0022] In certain embodiments, fluid level monitoring system 1000 may further comprise fluid level monitoring device 1300, wellhead remote visual monitoring device 1400, constant level subsea pump system 1500, umbilical flow conduit 1600, subsea control system umbilical 1800, subsea control module 1520, and surface operating unit 1700. In certain embodiments, submersible electric motor 1510 may power constant level subsea pump system 1500.

[0023] In certain embodiments, fluid level monitoring device 1300 may comprise a mud-line wellbore differential pressure monitoring device installed at subsea well isolation device 1200. In certain embodiments, the mud-line wellbore pressure monitoring device may comprise one or more pressure gauges 1900. In certain embodiments, the one or more pressure gauges 1900 may be located in subsea well isolation device 1200. In certain embodiments, an electrical connection may connect pressure gauge 1900 to subsea control system umbilical 1800.

[0024] In certain embodiments, wellhead remote visual monitoring device 1400 may be installed at wellhead 1110. In certain embodiments, wellhead remote visual monitoring device 1400 may comprise a subsea video camera with electrical connection to a control system that allows for viewing the video on the topside equipment. In certain embodiments, the video will monitor the height of the well fluid by using concentric circular grooves on a funnel.

[0025] In certain embodiments, umbilical flow conduit 1600 may connect subsea well 1100 to surface operating unit 1700. In certain embodiments, the umbilical flow conduit 1600 may be a kill line. In certain embodiments, umbilical flow conduit 1600 may be reeled tubing or drill pipe. In certain embodiments, umbilical flow conduit 1600 may provide fluid communication from surface operating unit 1700 to subsea well 1100.

[0026] In certain embodiments, fluid level monitoring system 1000 may further comprise logic control software capable of interpreting data streams from fluid level monitoring device 1300, constant level subsea pump system 1500, and one or more pressure gauges 1900. In certain embodiments, pressure gauges 1900 may be reliant on pressure gradient differential between the completion fluid subsea well 1100 and the seawater. In certain embodiments, the differential pressure may be used to measure the height of the fluid column inside the isolation device. In certain embodiments, the pressure gauges 1900 may measure the differential pressure between ambient seawater and the fluid column above the location of the one or more pressure gauges 1900 in the subsea well

isolation device 1200. Normally the fluid inside subsea well isolation device 1200 has a greater density than seawater. When the fluid level inside in the subsea well isolation device 1200 increases in height, the one or more pressure gauges 1900 may record an increase in differential pressure. Conversely when the fluid level in the isolation device
5 decreases (lowers) the one or more pressure gauges 1900 may record a decrease in differential pressure. In response to this change in differential pressure, constant level subsea pump system 1500 may operate to either lower or raise the fluid level according to the software in the subsea control module 1520. Wellhead remote visual monitoring device 1400 may be used to confirm the fluid column height.

10 **[0027]** In certain embodiments, the present disclosure provides a method of maintaining a constant fluid level within a wellbore comprising: providing a fluid level monitoring system comprising a subsea well comprising a wellbore and a wellhead, a subsea well isolation device installed on the wellhead, and a fluid level monitoring device and maintaining a constant fluid level within the wellbore. In certain embodiments, the
15 fluid level monitoring system may comprise any fluid level monitoring system described above with respect to fluid level monitoring system 1000. In certain embodiments, the fluid level monitoring system may measure the fluid level in the wellbore by measuring a pressure difference between seawater and the fluid in the well. In certain embodiments, a fluid level monitoring device may be used to measure the pressure difference between
20 seawater and the fluid in the well. In certain embodiments, the fluid level monitoring device may comprise any fluid level monitoring device described above with respect to fluid level monitoring device 1300. In certain embodiments, the measured pressure difference may be used to determine a motor speed and direction of a pump sufficient to maintain a constant fluid level within the wellbore. In certain embodiments, a remove
25 visual monitoring device may be used to confirm that the fluid level within the well is maintained at a constant level.

[0028] Referring now to Figure 2, Figure 2 illustrates fluid level monitoring system 2000. In certain embodiments, fluid level monitoring system 2000 may comprise subsea well 2100 and a subsea well isolation device 2200.

30 **[0029]** In certain embodiments, subsea well 2100 may comprise any subsea well discussed above with respect to subsea well 1100. In certain embodiments, a subsea well isolation device 2200 may be installed on a subsea wellhead 2110 of subsea well 2100. In certain embodiments, subsea well isolation device 2200 may comprise any subsea isolation

device discussed above with respect to subsea isolation device 1200.

[0030] In certain embodiments, fluid level monitoring system 2000 may further comprise fluid level monitoring device 2300, wellhead remote visual monitoring device 2400, constant level subsea pump system 2500, umbilical flow conduit 2600, subsea control module 2520, and surface operating unit 2700. In certain embodiments, submersible electric motor 2510 may power constant level subsea pump system 2500.

[0031] In certain embodiments, fluid level monitoring device 2300 may comprise a mud-line wellbore pressure monitoring device installed at subsea well isolation device 2200. In certain embodiments, fluid level monitoring device 2300 may comprise any combination of features discussed above with respect to fluid level monitoring device 1300.

[0032] In certain embodiments, wellhead remote visual monitoring device 2400 may be installed at wellhead 2110. In certain embodiments, wellhead remote visual monitoring device 2400 may comprise any combination of features discussed above with respect to wellhead remote visual monitoring device 1400.

[0033] In certain embodiments, umbilical flow conduit 2600 may connect subsea well 2100 to surface operating unit 2700. In certain embodiments, the umbilical flow conduit 2600 may comprise any combination of features discussed above with respect to umbilical flow conduit 1600. In certain embodiments, umbilical flow conduit 2600 may provide fluid communication from surface operating unit 2700 to subsea well 2100.

[0034] In certain embodiments, fluid level monitoring system 2000 may further comprise logic control software capable of interpreting data streams from fluid level monitoring device 2300, constant level subsea pump system 2500, and pressure gauges 2900. In certain embodiments, the differential pressure between pressure gauges 2900 may be used to measure the height of the fluid column inside the isolation device. In response to the measured differential pressure, the constant level subsea pump system 2500 may operate to either lower or raise the fluid level according to the software in the subsea control module 2520. Wellhead remote visual monitoring device 2400 may be used to confirm the fluid column height.

[0035] In certain embodiments, the present disclosure provides a method of maintaining a constant fluid level within a wellbore comprising: providing a fluid level monitoring system comprising a subsea well comprising a wellbore and a wellhead, a subsea well isolation device installed on the wellhead, and a fluid level monitoring device

and maintaining a constant fluid level within the wellbore. In certain embodiments, the fluid level monitoring system may comprise any fluid level monitoring system described above with respect to fluid level monitoring system 2000. In certain embodiments, the fluid level monitoring system may measure the fluid level in the wellbore by measuring the pressure difference between the one or more pressure gauges. In certain embodiments, a fluid level monitoring device may be used to measure pressure difference between the one or more pressure gauges. In certain embodiments, the fluid level monitoring device may comprise any fluid level monitoring device described above with respect to fluid level monitoring device 2300. In certain embodiments, the measured pressure difference may be used to determine a motor speed and direction of a pump sufficient to maintain a constant fluid level within the wellbore. In certain embodiments, a remove visual monitoring device may be used to confirm that the fluid level within the well is maintained at a constant level.

[0036] Referring now to Figure 3, Figure 3 illustrates a fluid level monitoring system 3000. In certain embodiments, fluid level monitoring system 3000 may comprise subsea well 3100 and a subsea well isolation device 3200.

[0037] In certain embodiments, subsea well 3100 may comprise any subsea well discussed above with respect to subsea well 1100 and/or subsea well 2100. In certain embodiments, a subsea well isolation device 3200 may be installed on a subsea wellhead 3110 of subsea well 3100. In certain embodiments, subsea well isolation device 3200 may comprise any subsea isolation device discussed above with respect to subsea isolation device 1200 and/or subsea isolation device 2200.

[0038] In certain embodiments, fluid level monitoring system 3000 may further comprise fluid level monitoring device 3300, wellhead remote visual monitoring device 3400, constant level pump system 3500, umbilical flow conduit 3600, subsea control module 3520, control umbilical 3800, and surface operating unit 3700. In certain embodiments, submersible electric motor 3510 may power constant level subsea pump system 3500.

[0039] In certain embodiments, fluid level monitoring device 3300 may be used to monitor the flow inside the isolation device 3200 or well 3100.

[0040] In certain embodiments, fluid level monitoring device 3300 may comprise one or more resistance temperature detectors. In certain embodiments, fluid level monitoring device 3300 may comprise temperature source 3311 and temperature sensor

3312. In certain embodiments, temperature sensor 3312 may be an insertion flow sensor commercially available from INTEK. In certain embodiments, temperature source 3311 and/or temperature sensor 3312 may be optical fibers such as optical fibers available from Smart Fibres.

5 **[0041]** In certain embodiments, fluid level monitoring system 3000 may monitor the fluid level by measuring an induced temperature variation in the wellbore fluid at the fluid monitoring device 3300. In certain embodiments, temperature source 3311 may induce a temperature variation in the wellbore that is detected by temperature monitor 3312. Data from the detected temperature variation may then be transferred to the surface
10 where computer software may interpret the data to determine the flow in the wellbore. Wellhead remote visual monitoring device 3400 may be used to confirm the fluid column height.

[0042] In certain embodiments, the present disclosure provides a method of maintaining a constant fluid level within a wellbore comprising: providing a fluid level
15 monitoring system comprising a subsea well comprising a wellbore and a wellhead, a subsea well isolation device installed on the wellhead, and a fluid level monitoring device and maintaining a constant fluid level within the wellbore. In certain embodiments, the fluid level monitoring system may comprise any fluid level monitoring system described above with respect to fluid level monitoring system 3000. In certain embodiments, the
20 fluid level monitoring system may measure the fluid level in the wellbore by inducing a temperature variation in the wellbore. In certain embodiments, a fluid level monitoring device may be used to measure the fluid level in the wellbore by inducing a temperature variation in the wellbore. In certain embodiments, the fluid level monitoring device may comprise any fluid level monitoring device described above with respect to fluid level
25 monitoring device 3300. In certain embodiments, the measured induced temperature variation in the wellbore may be used to determine a motor speed and direction of a pump sufficient to maintain a constant fluid level within the wellbore. In certain embodiments, a remove visual monitoring device may be used to confirm that the fluid level within the well is maintained at a constant level.

30 **[0043]** While the embodiments are described with reference to various implementations and exploitations, it will be understood that these embodiments are illustrative and that the scope of the inventive subject matter is not limited to them. Many variations, modifications, additions and improvements are possible.

[0044] Plural instances may be provided for components, operations or structures described herein as a single instance. In general, structures and functionality presented as separate components in the exemplary configurations may be implemented as a combined structure or component. Similarly, structures and functionality presented as a single
5 component may be implemented as separate components. These and other variations, modifications, additions, and improvements may fall within the scope of the inventive subject matter.

CLAIMS

1. A fluid level monitoring system comprising:
a subsea well comprising a wellbore and a wellhead;
a subsea well isolation device installed on the wellhead; and
5 a fluid level monitoring device.
2. The fluid level monitoring system of claim 1, wherein the fluid level monitoring device comprises a mud-line wellbore differential pressure monitoring device.
3. The fluid level monitoring system of claim 2, wherein the mud-line wellbore differential pressure device comprises one or more pressure gauges.
- 10 4. The fluid level monitoring system of claim 2 or 3, further comprising a wellhead remote visual monitoring device, a constant level subsea pump system, and a subsea control module.
5. The fluid monitoring system of any one of claims 2-4, further comprising an umbilical flow conduit, a subsea control system umbilical, and a surface operating unit.
- 15 6. The fluid level monitoring system of claim 1, wherein the fluid level monitoring device comprises a mud-line wellbore pressure monitoring device.
7. The fluid level monitoring system of claim 6, wherein the mud-line wellbore pressure device comprises one or more pressure gauges.
8. The fluid level monitoring system of claim 6 or 7, further comprising a
20 wellhead remote visual monitoring device, a constant level subsea pump, and a subsea control module.
9. The fluid monitoring system of any one of claims 6-8, further comprising an umbilical flow conduit, a subsea control system umbilical, and a surface operating unit.
10. The fluid level monitoring system of claim 1, wherein the fluid level
25 monitoring device comprises one or more resistance temperature detectors.
11. The fluid level monitoring system of claim 10, wherein the fluid level monitoring device comprises a temperature source and a temperature sensor.
12. The fluid level monitoring system of claim 10 or 11, further comprising a wellhead remote visual monitoring device, a constant level subsea pump system, and a
30 subsea control module.

13. The fluid monitoring system of any one of claims 10-12, further comprising an umbilical flow conduit, a subsea control system umbilical, and a surface operating unit.

14. A method of maintaining a constant fluid level within a wellbore comprising:

- 5 providing a fluid level monitoring system comprising a subsea well comprising a wellbore and a wellhead, a subsea well isolation device installed on the wellhead, and a fluid level monitoring device and
 maintaining a constant fluid level within the wellbore.

15 15. The method of claim 14, wherein the fluid level monitoring device comprises a mud-line wellbore differential pressure device comprising one or more pressure gauges and the fluid level monitoring system further comprises a wellhead remote visual monitoring device, a constant level subsea pump system, and a subsea control module.

16. The method of claim 15, wherein maintaining a constant fluid level within the wellbore comprises measuring a pressure difference with the mud-line wellbore pressure monitoring device to determine the fluid level in the wellbore.

17. The method of claim 14, wherein the fluid level monitoring device comprises a mud-line wellbore pressure monitoring device and the fluid level monitoring system further comprises a wellhead remote visual monitoring device, a constant level subsea pump system, and a subsea control module.

18. The method of claim 17, wherein maintaining a constant fluid level within the wellbore comprises measuring a pressure difference with the mud-line wellbore pressure monitoring device to determine the fluid level in the wellbore.

19. The method of claim 14, wherein the fluid level monitoring device comprises one or more resistance temperature detectors and the fluid level monitoring system further comprises a wellhead remote visual monitoring device, a constant level subsea pump system, and a subsea control module.

20. The method of claim 19, wherein maintaining a constant fluid level within the wellbore comprises inducing a temperature variation in the wellbore and measuring the induced temperature variation to determine the fluid level in the wellbore.

FIGURE 1

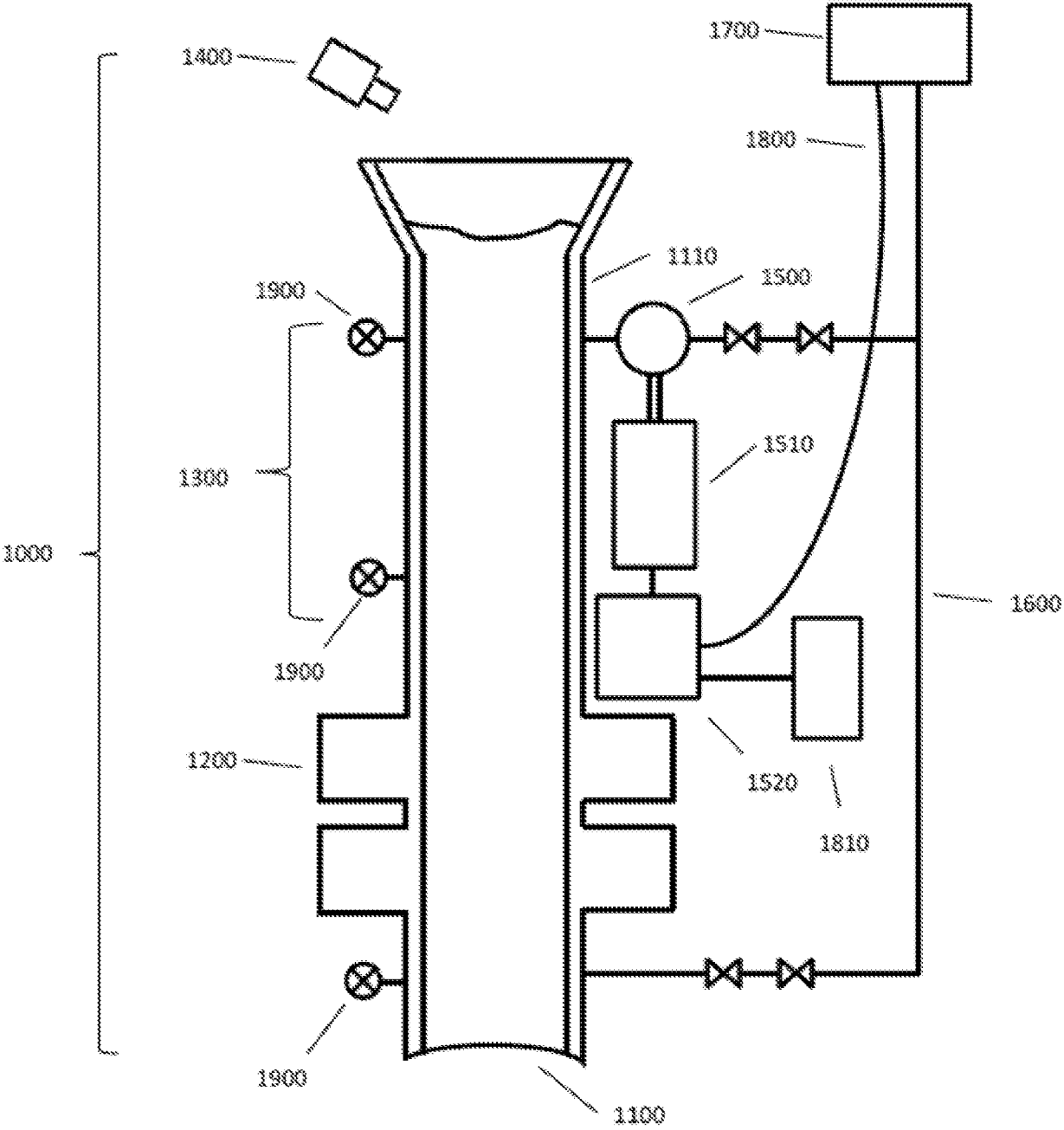


FIGURE 2

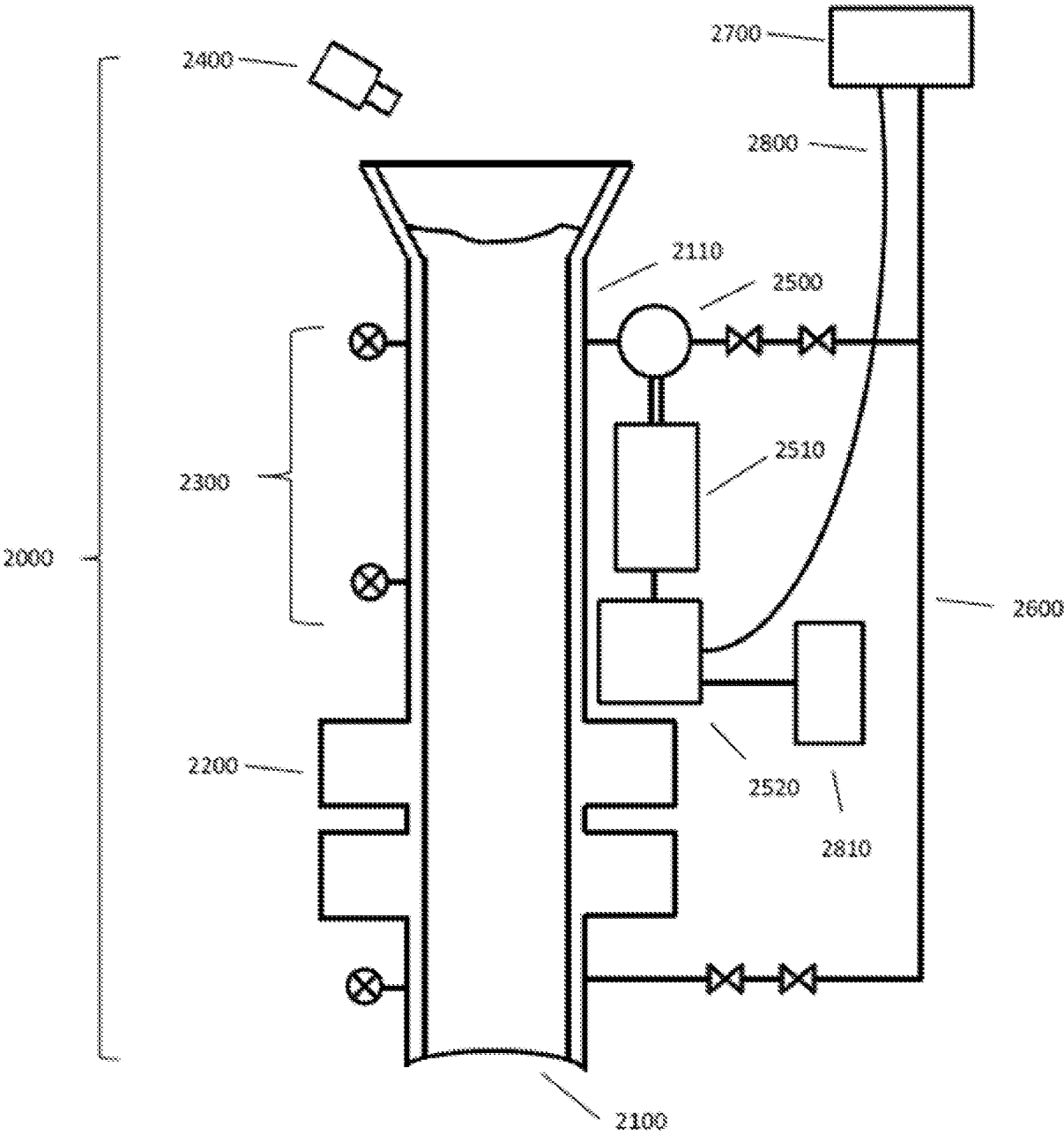
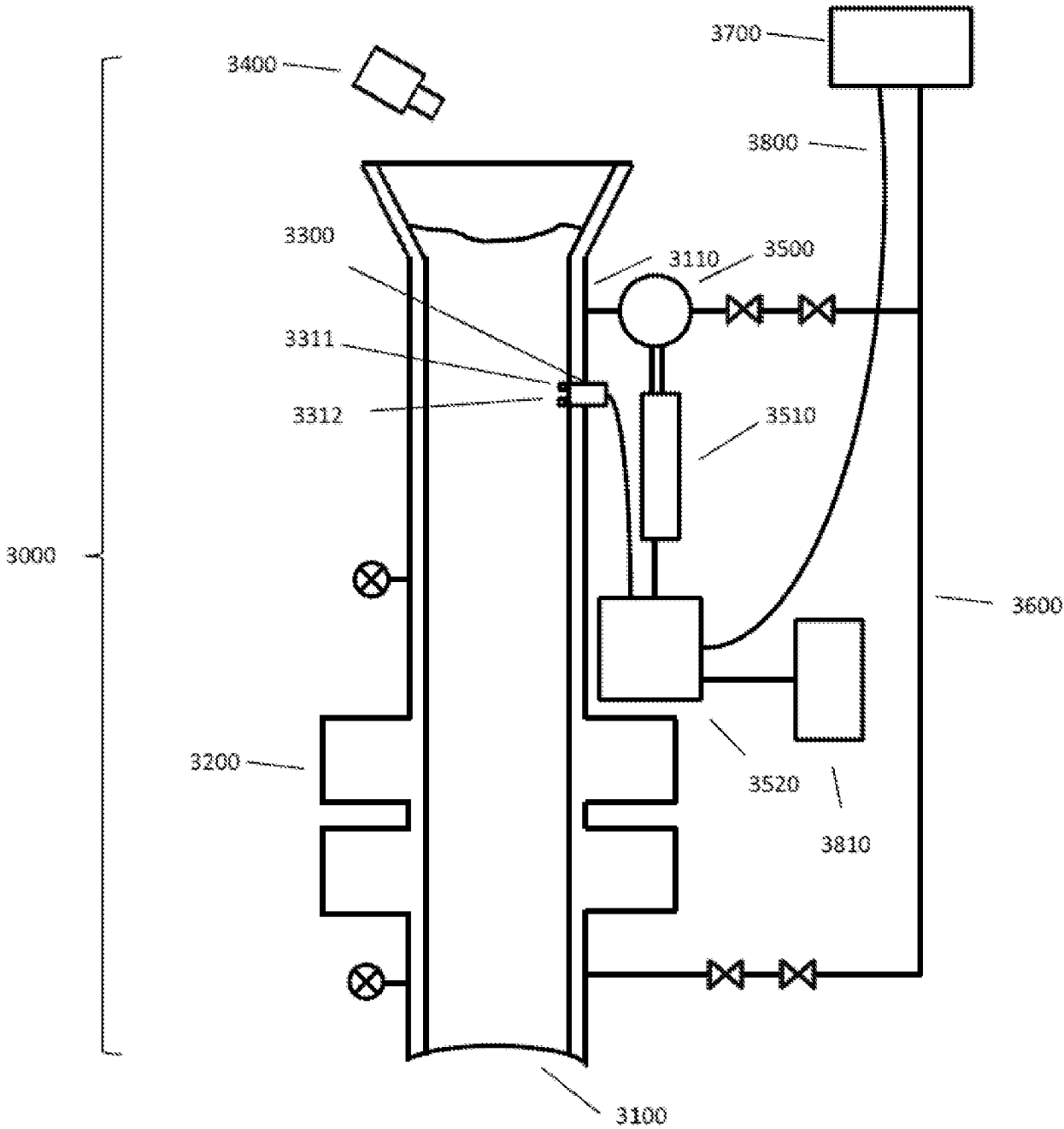


FIGURE 3



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/020070

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B47/04 E21B47/00
ADD.

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)
E21B

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)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2011/058031 A2 (OCEAN RISER SYSTEMS AS [NO]; FOSSLI BOERRE [NO]; SANGESLAND SIGBJOERN) 19 May 2011 (2011-05-19) paragraph [0057] - paragraph [0061]; figures 2-5	1-9, 14-18
X	WO 2012/015315 A1 (OCEAN RISER SYSTEMS AS [NO]; POTTER PAUL ANTHONY [IT]; GLEDITSCH SVEIN) 2 February 2012 (2012-02-02) page 8, line 15 - page 9, line 18; figure 3	1,14



Further documents are listed in the continuation of Box C.



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

"E" earlier application or patent but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search

10 May 2016

Date of mailing of the international search report

24/08/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Authorized officer

Pieper, Fabian

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/020070

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014/155126 A2 (IKM CLEANDRILL AS [NO]; HASLER THOMAS [NO]) 2 October 2014 (2014-10-02) page 14, line 15 - page 15, line 10 page 16, line 30 - page 17, line 34 page 20, line 16 - line 21 figures 1, 2	1-9
X	----- US 2014/174751 A1 (LUGO MARIO R [US] ET AL) 26 June 2014 (2014-06-26)	1
A	paragraph [0030] - paragraph [0031] -----	5,14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/020070

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
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:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of Item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ 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.:
4. ☒ 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.:

1-9, 14-18

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ 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.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9, 14-18

Fluid level monitoring with pressure monitoring

2. claims: 10-13, 19, 20

Fluid level monitoring with resistance temperature detectors

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/020070

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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