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**Datasheet for the decision
of 26 June 2014**

Case Number: T 1169/11 - 3.2.03

Application Number: 01271487.9

Publication Number: 1356186

IPC: E21B21/08, E21B44/00

Language of the proceedings: EN

Title of invention:

CLOSED LOOP FLUID-HANDING SYSTEM FOR WELL DRILLING

Patent Proprietor:

Secure Drilling International, L.P.

Opponent:

Shell Internationale Research Maatschappij B.V.

Headword:

Relevant legal provisions:

EPC Art. 114, 84, 123(2), 56
RPBA Art. 12(4), 13(1), 13(3)

Keyword:

Late-filed request - admitted (yes)
Amendments - added subject-matter (no)
Inventive step - (yes)

Decisions cited:

Catchword:



**Beschwerdekammern
Boards of Appeal
Chambres de recours**

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 1169/11 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 26 June 2014

Appellant II: Secure Drilling International, L.P.
(Patent Proprietor) 12777 Jones Road Suite 2800
Houston TX 77070 (US)

Representative: Williams, Michael Ian
Cleveland
10 Fetter Lane
London EC4A 1BR (GB)

Appellant I: Shell Internationale Research Maatschappij B.V.
(Opponent) Carel van Bylandtlaan 16
NL-2596 HR The Hague (NL)

Representative: Giovannini, Francesca
Osha Liang
32, avenue de l'Opéra
75002 Paris (FR)

Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
28 March 2011 concerning maintenance of the
European Patent No. 1356186 in amended form.**

Composition of the Board:

Chairman G. Ashley
Members: V. Bouyssy
M. Blasi

Summary of Facts and Submissions

I. European patent No. 1 356 186 (in the following: "the patent") concerns *inter alia* a method and a system for operating a well while being drilled with a drill string having a drilling fluid circulated therethrough.

II. The patent as a whole was opposed on the grounds of Article 100(c) and Article 100(a) EPC for lack of inventive step. The opposition division decided that the ground of opposition under Article 100(c) EPC prejudiced the maintenance of the patent as granted and that the patent could be maintained on the basis of the first auxiliary request as filed before it (Article 101(3) (a) EPC).

III. This interlocutory decision of the opposition division has been appealed by the opponent (here Appellant I) and by the patent proprietor (here Appellant II).

IV. With the summons to oral proceedings, the Board sent a communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA) indicating to the parties its preliminary, non-binding opinion of the case.

V. Oral proceedings before the Board were held on 26 June 2014.

VI. Requests

Appellant I requested that the decision under appeal be set aside and the patent be revoked.

Appellant II requested that the decision under appeal be set aside and the patent be maintained on the basis

of the set of claims according to Annex 2 filed during the oral proceedings.

VII. Claims

Claim 1 reads as follows (compared to claim 1 as granted, added features are indicated in bold, deleted features in strike-through):

"1. Method for operating a well while being drilled with a drill string (1) having a drilling fluid circulating therethrough, while the well is kept closed **with a pressure containment device** at all times, wherein the method comprises in relation to a system comprising:

- a) a pressure containment device (26) to the wellbore;
- c) means (10, 11, 15, 16) for measuring mass and~~or~~ fluid flow rate on the inlet and outlet streams;
- e) at least one pressure sensor (17, 28) to obtain pressure signals;
- f) optionally at least one temperature sensor (17, 28) to obtain temperature data;
- g) a central data acquisition and control system (18); said method comprising the steps of
- h) injecting drilling fluid through an injection line through which said fluid is made to contact said mass and~~or~~ fluid flow meters and said pressure sensor, and recovering drilling fluid through a return line;
- i) collecting drill cuttings at the surface;
- j) measuring the mass and~~or~~ fluid flow in and out of the well and collecting mass and~~or~~ fluid flow signals;
- l) measuring pressure of fluid and collecting pressure signals;
- m) directing all the collected flow and pressure signals to the said central data acquisition and control system;

n) the software of the central data acquisition and control system considering, at each time, ~~a predicted signal~~ **the predicted flow out of the well;** characterised in that the system comprises additionally

b) a pressure/flow control device (12) on the outlet stream to control the flow out of the well and to keep a back pressure on the well;

q) and in that the central data acquisition and control unit is additionally programmed to compare said real time predicted ~~signal~~ **out flow** to the actual ~~signal~~ **out flow;**

and in that the method comprises additionally

o) having the actual and predicted ~~signals~~ **out flows** compared and checked for any discrepancy;

r) wherein the method and software act on the principle of mass ~~or volume~~ conservation, to determine the difference in mass ~~or volume~~ being injected and returned from the well, compensates for ~~factors including~~ increase in hole volume, additional mass of rock returning **and other factors** as an indication of the nature of the fluid event occurring downhole;

s) **said software designed to predict an expected, ideal value for outflow, based on calculations taking into account several parameters, and compare the predicted ideal value with the actual, return value as measured by flow meters,** said comparison yielding any ~~said discrepancy~~ **discrepancies,** said software also receiving as input any early detection parameters, which input triggers a chain of investigation of probable scenarios, **checking of actual other parameters and other means** to ascertain that an influx/loss event has occurred;

t) and converting said discrepancy to a value for adjusting the pressure/flow control device and restoring the predicted ~~signal-value~~ **out flow rate,** and

p) in case of discrepancy, having a signal sent by the central data acquisition and control system to adjust the pressure/flow control device and restore the predicted ~~signal value~~ **out flow rate** without interruption of the drilling operation."

Dependent claims 2 to 27 concern preferred embodiments of the method of claim 1. Claims 28 to 43 relate to a system for operating a well. Independent claim 44 concerns a method for constructing a system as defined in any of claims 28 to 43. Claims 45 to 53 concern a central data acquisition and control system for use in a system for operating a well. Independent claim 54 relates to a method for operating a central data acquisition and control unit for use in a system for operating a well.

VIII. Cited evidence

The parties relied on the following documents which are cited in the appealed decision:

- D1: US 5 168 932 A
- D2: US 5 975 219 A
- D3: Gerd Schaumberg, "Bohrloch Kontroll Handbuch - Handbuch für die Bohrlochkontrollschulungen der Bohrmeisterschule Celle", "Band 1 - Grundlagen" pages 8, 9, 26 to 33, 38 to 40, 43 to 48, 59 to 61, 103 to 108, 113 to 116, 129, 130, 155 to 158, and "Band 2 - Well Control Equipment", pages 47 to 50, 85, 89, 90
- D4: US 3 552 502 A

With its letter dated 11 June 2014, Appellant I filed the following document:

D3a: Gerd Schaumberg, "Bohrloch Kontroll Handbuch - Handbuch für die Bohrlochkontrollschulungen der Bohrmeisterschule Celle", "Band 2 - Well Control Equipment", Impressum, Vorwort, Inhaltsverzeichnis

IX. The arguments of the parties in the written and oral proceedings can be summarised as follows:

a) Admissibility of the amended claims

Appellant I requested the Board not to admit the set of amended claims into the proceedings because it could have been filed in the opposition proceedings, or at the latest with the statement of grounds of appeal; it raised new issues; and it was *prima facie* objectionable to under Articles 123(2) and 84 EPC.

Appellant II submitted that the set of claims was filed in reaction to the objections of Appellant I under Article 100(c) EPC and to the preliminary opinion of the Board; in addition the amendments did not raise any new issue as they only concerned the introduction of features as had been put forward by Appellant I itself.

b) Claim 1 - Articles 100(c) and 123(2) EPC

Appellant I's case:

Claim 1 contravened Article 100(c) *inter alia* because it did not specify that the method was a "continuous, safe operation" as was disclosed in the application as originally filed; it defined the provision of "at least one temperature sensor" only as an optional feature when it had originally been disclosed as being essential; the combination of features (a) to (p) with

features (q) to (t) could not be derived from the application as originally filed; and there was no support for the wording of features (q) to (t). Moreover, the amended wording "mass and fluid flow" in features (c), (h) and (n) could not be derived from the application as originally filed, contrary to Article 123(2) EPC.

Appellant II's case:

Claim 1 as amended was essentially based on claims 13, 23, 32, 35, 49 and 53 as originally filed. A number of Appellant I's objections/arguments under Article 100(c) EPC should not be admitted into the appeal proceedings because they were either late-filed or had not been raised during the opposition proceedings. This also applied to the objection under Article 123(2) EPC.

c) Claim 1 - Article 84 EPC

Appellant I contended that feature (r) of claim 1 lacked clarity, because the "other factors" were not precisely defined.

Appellant II replied that a skilled reader would readily understand from the wording of feature (r) that the method/software compensates for increase in hole volume, additional mass of rock returning and any other relevant factors.

d) D3

Faced with the submission of Appellant II that no evidence of the publication of D3 had been provided, Appellant I filed D3a. During the oral proceedings, Appellant II confirmed that it no longer contested the public availability of D3 prior to the priority date of the patent.

e) Claim 1 - Inventive step vs D1

Appellant I's case:

Claim 1 differed from D1 in that

- "the well is kept closed with a pressure containment device at all times",
- drill cuttings are collected at the surface (feature (i)), and
- the method/software "compensates for increase in hole volume, additional mass of rock returning and other factors as an indication of the nature of the fluid event occurring downhole" (part of feature (r)).

Since these distinguishing features did not interact to achieve a synergistic effect, they could be treated independently when assessing inventive step. Each of these features was a well known measure, see e.g. textbook D3, which the skilled person would employ, if required, on the basis of his expert knowledge. Hence, the subject-matter of claim 1 was obvious over D1 in view of common general knowledge, such as documented in D3.

Appellant II's case:

D1 failed to disclose the feature that "the well is kept closed with a pressure containment device at all times" as well as features (a), (i), (b) and (n) to (t). The problem to be solved was how to improve the method of D1 so that kicks could be detected early and controlled without interruption of the drilling operation. The claimed solution to this problem was not part of common general knowledge. In particular, the solution was neither disclosed nor suggested in D3, since D3 only described the provision of a rotating head/preventer to close a well while drilling in underbalanced condition, i.e. when formation fluid was purposively allowed to flow in the well. Moreover, the rotating head/preventer as disclosed in D3 could not be implemented in the drilling system of D1. Thus, starting from D1, the claimed invention involved an inventive step.

f) Claim 1 - Inventive step vs D2

Appellant I's case:

Claim 1 differed from D2 only by features (i), (t) and (p) and the feature that the method/software "compensates for increase in hole volume, additional mass of rock returning and other factors as an indication of the nature of the fluid event occurring downhole" (part of feature (r)). Since there was no synergistic effect arising from the combination of these distinguishing features, they could be discussed independently for inventive step. Feature (i) was a standard measure, see e.g. D3. In view of D3, D4 and common general knowledge, a skilled person aiming to control the well would have considered providing

features (r), (t) and (p). Thus, the subject-matter of claim 1 was obvious over D2 in view of D3, D4 and common general knowledge.

Appellant II's case:

In Figures 1 to 6 of D2, the well was closed while drilling with natural gas, preferably in underbalanced pressure condition. In Figure 7 of D2, the well was kept open while drilling with a conventional mud in overbalanced pressure condition, and the drilling arrangement comprised flow meters to monitor a possible discrepancy between drilling mud inflow and outflow thereby allowing early detection of a kick followed by alerting the operator with an alarm signal. The embodiment of Figure 7 thus came closer to the invention than the embodiment of Figures 1 to 6. The embodiment in Figure 7 failed to disclose the feature that "the well is kept closed with a pressure containment device at all times" and features (a), (i), (b) and (n) to (t). Starting from Figure 7 of D2, the objective problem to be solved could thus be formulated as for D1, i.e. earlier detection and control of kicks without interrupting the drilling process. The claimed solution was not part of common general knowledge and was neither disclosed nor suggested by D3 or D4. In particular, D4 only taught that the flow of mud was controlled while killing a kick, not while actively drilling. Hence, starting from D2, the claimed invention involved an inventive step.

Reasons for the Decision

1. Admissibility of objections under Articles 100(c) and 123(2) EPC

1.1 In its statement of grounds of appeal, Appellant I contended that claim 1 as granted contravened Article 100(c) EPC because

- 1) claim 1 lacked the feature that "the well is kept closed ... at all times" by the pressure containment device;
- 2) claim 1 lacked the feature of claim 35 as filed that the method is a "continuous, safe operation";
- 3) claim 1 defined the provision of "at least one temperature sensor" only as an optional feature;
- 4) the combination of features (a) to (p) with features (q) to (t) of claim 1 could not be derived from the application as filed;
- 5) the wording "mass and/or fluid flow" in features (c), (h) and (j) of claim 1 introduced added subject-matter;
- 6) the terms "actual signal" and "predicted signal" in features (n) to (q) and (t) of claim 1 went beyond the original teaching in the application as filed; and
- 7) the wording of features (q) to (t) introduced added subject-matter.

With respect to the first auxiliary request which the opposition division found to meet Articles 100(c) and 123(2) EPC, Appellant I contended that

- 8) the wording "mass and fluid flow" in features (c), (h) and (j) contravened Article 123(2) EPC.

1.2 Objections (1) to (4) had already been raised in the opposition proceedings, albeit after expiry of the opposition period. It follows from the appealed decision and the minutes of the oral proceedings that the opposition division exercised its discretion under Article 114 EPC to admit objections (1) to (4) into the proceedings. These objections will thus be considered by the Board.

1.3 Objections (5) and (6) were raised before expiry of the opposition period, hence will also be considered.

1.4 Although objection (7) was presented by Appellant I for the first time in the appeal proceedings, the Board has decided to admit it into the proceedings for the following reason. This objection concerns further arguments in support of objection (4), which were presented in reaction to the adverse decision of the opposition division. Since these new arguments do not constitute a fresh case, there is no reason not to admit them into the appeal proceedings.

1.5 The Board decided to admit objection (8) into the proceedings because it relates to objection (5) and was already considered by the opposition division in the appealed decision (see point 2.3 thereof).

2. Admissibility of the amended claims

2.1 Appellant II filed the present set of amended claims during the oral proceedings before the Board, in replacement of its main request filed with letter dated 23 June 2014 and its auxiliary requests filed with letter dated 22 Mai 2014. Appellant I had objected to the admissibility of these main and auxiliary requests and also of this last request.

- 2.2 The Board agrees with Appellant I that the filing of the amended claims constitutes a very late change to Appellant II's case. In accordance with Article 114(2) EPC and Articles 13(1) and (3) RPBA, it lies within the discretion of the Board whether or not to admit this request.
- 2.3 The Board considers that the present set of amended claims was filed in reaction to the preliminary opinion of the Board and to Appellant I's objections raised in the letter dated 11 June 2014 and during the oral proceedings. In fact, the amendments relate to the introduction of limiting features in the claims with the aim of overcoming most of Appellant I's objections under Articles 100(c) and 123(2) EPC, and the Board considers the issues arising from the amendments to be of limited complexity. Thus, the Board came to the conclusion that the amendments do not raise issues which the Board or Appellant I could not reasonably be expected to deal with without adjournment of the oral proceedings.
- 2.4 In the opposition proceedings, Appellant I as opponent raised six objections under Article 100(c) EPC against claim 1 as granted (see objections (1) to (6) in point 1.1 above). Appellant I submitted that Appellant II as proprietor could and should already have filed the present request during the opposition proceedings or at the outset of the appeal proceedings. Appellant I concluded that the amended claims should not be admitted into the appeal proceedings because they could have been presented in the opposition proceedings (Article 12(4) RPBA), or at the latest with the statement of grounds of appeal (Article 13(1) RPBA). The Board does not agree.

Appellant II, as proprietor, filed two auxiliary requests in reaction to the preliminary opinion of the opposition division, and the opposition division found that the first auxiliary request satisfied Articles 100(c) and 123(2) EPC. Thus, in the opposition proceedings, Appellant II had no objective reason to file any further request. This held also true when Appellant II filed its statement of grounds of appeal, since it challenged only the decision of the opposition division against its main request. In its reply to Appellant I's appeal, Appellant II still had no objective reason to file the present request because it relied on the positive decision of the opposition division and it submitted that most of Appellant I's objections under Article 100(c) and 123(2) EPC should not be admitted into the proceedings. The Board therefore sees no abuse of procedure on the part of Appellant II.

2.5 Thus, the Board decided to admit Appellant II's new request under Article 114(2) EPC and Articles 13(1) and (3) RPBA.

3. Claim 1 - Articles 100(c) and 123(2) EPC

3.1 Claim 1 corresponds essentially to a combination of claims 13, 23, 32, 35, 49 and 53 as originally filed.

3.1.1 Means for keeping the well closed

Claim 1 as amended makes clear that the well is kept closed at all times by means of the pressure containment device, as disclosed for instance on page 1, line 10 of the application as originally filed.

3.1.2 Continuous and safe operation

Appellant I submitted that claim 1 should contain the phrase "continuous, safe operation", in line with the disclosure in originally filed claim 35. However, the wording of claim 35 can be found in the application at page 31, line 4 to page 32, line 4, without the expression "continuous, safe operation". Thus, the teaching here provides a basis for the omission of the expression "continuous, safe operation".

Further, as explained by Appellant II, a skilled reader would understand that, in the context of original claim 35, the term "continuous operation" simply means that the pressure/control device is adjusted without interruption of the drilling operation. This understanding of "continuous operation" is confirmed by the teaching at page 30, lines 13 to 17 of the application. Hence, in claim 1 as amended, the wording of feature (p) ("... without interruption of the drilling operation") implies that the claimed method is a "continuous operation", without the need to state it expressly.

The expression "safe" is subjective and there is no reason to doubt that the method defined in claim 1 is safe, as defined in the application (see e.g. page 5, lines 22 and 27; page 19, lines 2 and 3; page 20, lines 5 and 6; page 28, lines 25 and 26; page 64, lines 8, 17, 20 and 22).

3.1.3 Temperature sensor

Present claim 1 defines the provision of "at least one temperature sensor" as optional, whereas one is

specified in the disclosure in originally filed claim 35 and on page 31, line 15 of the application.

However, a skilled reader of the application would readily recognise that the provision of a temperature sensor is advantageous but not indispensable for the function of the invention in the light of the problem to be solved, namely the early detection of kicks and their control without interruption of the drilling operation. For instance, the temperature sensor is presented as being optional in the paragraph bridging pages 21 and 22 and at page 23, lines 12 to 26. Thus, even though a temperature sensor is required in original method claim 35, the skilled reader would recognise that this feature could be omitted.

3.1.4 Features (q) to (t)

As indicated above, claim 1 corresponds essentially to a combination of original claims 13, 23, 32, 35, 49 and 53. Feature (q) is taken from original claim 13 (see feature (f) thereof). Feature (r) is taken from original claim 53. Feature (s) stems from original claim 49. Feature (t) derives from original claim 32 and page 28, lines 17 to 21 as originally filed.

Even though original claim 13 is directed to a system for operating a well while original claims 23, 32 and 35 define a method for operating a well, it is clear that the system features can be combined with the method features since the claimed method is carried out using the claimed system (see the corresponding wording in system claim 1 and method claim 22; page 18, line 4; page 25, line 22; page 28, lines 8-9; method shown in Figures 7 and 8 and system in Figures 4 to 6).

Original claims 49 and 53 are directed to software "for a system as claimed in any of claims 1 to 21 or method of any of claims 22 to 47" (see claim 49 to which claim 53 directly refers). Thus, the software features in claims 49 and 53 are disclosed in combination with the system features of claim 13 and the method features of claims 23, 32 and 35.

3.1.5 Mass and fluid flow

The step of measuring/monitoring "mass flow rates" and "fluid flow rates" is disclosed at page 43, lines 6 and 7 and at page 48, lines 8 to 15 and also in claims 14 and 35. Claim 35 as originally filed provides a basis for using the term "fluid flow" instead of "volumetric flow".

3.1.6 Actual signal and predicted signal

With respect to claim 1 as granted, Appellant I argued, as had the opposition division, that the broad terms "actual signal" and "predicted signal" in features (n) to (q) and (t) went beyond the teaching in the application as originally filed. This objection has been overcome by amending the above terms to "actual out flow" and "predicted out flow" respectively.

3.2 Hence, the Board considers that the subject-matter of amended claim 1 does not extend beyond the content of the application as originally filed (Article 100(c) EPC) and that the amendments meet the requirements of Article 123(2) EPC.

4. Claim 1 - Article 84 EPC

4.1 The Board is satisfied that the amendments made in claim 1 also meet the requirements of Article 84 EPC.

4.2 Feature (r) of claim 1 was amended by replacing the wording "compensates for factors including increase in hole volume, additional mass of rock returning" by "compensates for increase in hole volume, additional mass of rock returning and other factors". Appellant I argued that a lack of clarity arises because the "other factors" are not specified.

However, the Board agrees with Appellant II that a skilled reader would readily understand from the wording of amended feature (r) that the method/software compensates for increase in hole volume, additional mass of rock returning and any "other" relevant "factors". A third party would have no difficulty in establishing whether he acted outside or within the scope of the claim. Hence, the clarity requirement is satisfied.

5. D3

It was no longer contentious between the parties that D3 formed part of the state of the art in accordance with Article 54(2) EPC. In light of D3a, the Board has also no doubt in this respect.

6. Claim 1 - Inventive step

6.1 Claim 1 is restricted compared to claim 1 of the first auxiliary request filed in the opposition proceedings, which the opposition division found to be inventive when starting from either D1 or D2.

6.2 Claim 1 - Inventive step vs. D1

6.2.1 D1 discloses a method and an apparatus for detecting fluid influx from an earth formation to a wellbore, e.g. a kick, and thereby allowing appropriate measures to be taken so that control of fluid flow in the wellbore is maintained. Thus, D1 can be regarded as an appropriate starting point for the assessment of inventive step.

6.2.2 D1 fails to disclose the feature that "the well is kept closed with a pressure containment device at all times" while actively drilling (preamble of claim 1) as well as feature (i) ("collecting drill cuttings at the surface").

6.2.3 The parties have disputed whether or not features (a), (b) and (n) to (t) further distinguish claim 1 from D1.

(a) Feature (a)

Appellant I argued that the blow out preventer 11 of D1 (in the following: BOP), which is located at the upper end 9 of the wellbore 5 and below the marine riser 13, forms a "pressure containment device ... to the wellbore". However, BOP 11 is kept open while drilling (see Figures 1 and 2), with an annular space 80 being formed between the drill string 30 on one hand and the wellbore 5, the blowout preventer 11, and the riser 13 on the other hand (column 3, lines 40 to 42). If BOP 11 were to be closed, it would prevent any drilling fluid from entering the riser 13 and thus would render it impossible to carry out the method of D1. In fact, a skilled reader would understand that BOP 11 is closed only to kill a kick (see "appropriate measures" in

column 4, lines 10 to 20, in combination with the definition of "appropriate measures" in column 1, lines 22 to 27). Hence, BOP 11 of D1 cannot form a "pressure containment device ... to the wellbore" in the sense of claim 1, whose function is to keep the well closed at all times while actively drilling (see preamble of claim 1). Thus, D1 does not disclose feature (a).

(b) Feature (b)

Appellant I argued that this feature is anticipated by the positive displacement pump 46 of D1, e.g. a Moineau type pump. The function of this pump is to pump liquid through the branch conduit 38 (column 3, lines 14 to 18). In a first mode of operation, the control system 60 controls the pump 46 so that the flow rate of drilling liquid coming out of the riser 13 through the branch conduit 38 is the same as the flow rate of drilling liquid being pumped into the riser through the supply conduit 34 and via the drill string 30 (column 3, line 62 to col 4, line 3). In a second mode of operation, the control system 60 controls the pump 46 to minimise a variation of the hydrostatic fluid pressure in the riser 13 (column 4, lines 21 to 27). Hence, in both modes of operation, the pump 46 controls the flow out of the riser 13, but it neither "control(s) the flow out of the well" nor "keep(s) a back pressure on the well". Hence, D1 does not disclose feature (b).

(c) Features (n) to (t)

It follows from features (n) to (t) *inter alia* that the central data acquisition and control system predicts an expected, ideal outflow, based on calculations (feature (s)), compares this real time predicted outflow with

the actual outflow (features (n), (o), (q), (r) and (s)) and converts any discrepancy to a value for adjusting the pressure/flow control device, and thus the back pressure on the well (see feature (b)), and for restoring the predicted outflow rate without interruption of the drilling operation (features (p) and (t)).

Such a control system is not disclosed in D1. The control system 60 compares the actual inflow and outflow rates as measured by the flowmeters 36 and 48 in the supply conduit 34 and the branch conduit 38 (see column 3, line 67 to column 4, line 1 and column 4, lines 23 to 33). In the first mode of operation (see point 6.2.3 b) above), if a difference is detected between the actual flow rates, the pump 46 is operated to adjust the outflow rate and to maintain a constant fluid level in the riser 13 (column 3, lines 1 to 3). If the fluid level varies, the control system 60 transmits a signal to a monitor 70. In the second mode of operation (see point 6.2.3 b) above), the control system 60 transmits a signal to the monitor 70 if a difference is detected between the actual flow rates (column 4, lines 31 to 33 and lines 43 to 46). Then, in both modes of operation, an operator can take "appropriate measures" if need be, see column 4, lines 20 and 47. It is clear that these "appropriate measures" are the conventional "appropriate measures" as defined in column 1, lines 24 to 27 of D1, i.e. the wellbore is shut by closing BOP 11 and a heavier fluid is pumped into the wellbore so as to increase the hydrostatic pressure in the wellbore. By doing so, the operator interrupts the drilling operation. Thus, the control system of D1 neither predicts an expected, ideal outflow at all times, nor checks predicted and actual outflows for discrepancy by applying the

principle of mass conservation, nor adjusts the back pressure on the well and restores the predicted outflow rate without interruption of the drilling operation. D1 thus fails to disclose features (n) to (t).

- 6.2.4 In conclusion, claim 1 differs from D1 *inter alia* by the feature that "the well is kept closed with a pressure containment device at all times" while actively drilling (preamble of claim 1) as well as by features (a), (i), (b) and (n) to (t).
- 6.2.5 The technical effect of these distinguishing features is that a closed loop fluid-handling system is provided, which continuously detects any influx/loss event while drilling and adjusts the back pressure on the well accordingly, thereby achieving the pressure balance required to avoid influx/loss (in the patent specification, see e.g. paragraphs [0001], [0017], [0038], [0044], [0046], [0054], [0091]). In particular, an unexpected kick can be detected early and controlled quickly and safely, without interruption of the drilling operation (see paragraphs [0017] and [0107] to [0109]). Hence, starting from D1, the objective technical problem to be solved is to improve the detection and control of kicks, as is set in paragraph [0017] in the patent specification.
- 6.2.6 The claimed solution to this problem is not rendered obvious by common general knowledge, nor by the teaching of D3.
- 6.2.7 Appellant I submitted that there is no functional reciprocal relationship between the distinguishing features. Keeping the well closed with a pressure containment device at all times would be a standard measure for operating under safer conditions (see e.g.

D3, Band 2, paragraph 4.3.5). Feature (i) would be a well known standard operation in well drilling (see e.g. D3, Band 1, paragraph 2.1.1.3). Feature (r) would be an obvious measure to provide response to the change in status of the well as drilling advances (see e.g. D3, Band 1, paragraphs 2.1.1 and 2.1.1.4).

This argument is not convincing. Firstly, it ignores the afore mentioned technical effect of the combination of the distinguishing features. Secondly, in this argumentation, Appellant I did not address any of distinguishing features (b), (n) to (q), (s) and (t).

6.2.8 Appellant I further contended that, if a sudden influx were to occur, the system of D1 would run in an underbalanced pressure condition for a period of time, before the influx is detected and appropriate measures are taken to control fluid flow in the wellbore. A skilled person would inevitably consider the provision of a rotating control head or a rotating blow out preventer to overcome this problem (see e.g. D3, Band 1, chapter 9.4 and Band 2, paragraph 4.3.5). By doing so, he would arrive at the feature of claim 1 that "the well is kept closed with a pressure containment device at all times". Indeed, paragraph [0039] of the patent specification discloses that the "pressure containment device" may be "a rotating blow out preventer" or "a rotating control head".

This argument is also not convincing. Rotating control heads (RCH) and rotating blow out preventers (RBOP) are devices commonly used in air/foam drilling and underbalanced drilling. Owing to its limited capability to control fluid influxes, air/foam drilling is generally used only in formations with little to no influx of formation fluid. In underbalanced drilling,

the bottom pressure is intentionally kept below the formation pressure to permit influx of formation fluid (see e.g. D3, Band 1, chapter 9.4). Thus, these devices find use in drilling methods which are different from the overbalanced drilling method as disclosed in D1, where the bottom pressure is higher than the formation pressure so as to avoid influx of formation fluid while drilling.

Starting from the overbalanced drilling method of D1, the skilled person would have no motivation to consider using a RCH/RBOP, which was developed for drilling methods allowing or encouraging influx of formation fluid. Even though the drilling method of D1 might occasionally experience an unexpected influx due to an underbalanced formation pressure, this does not mean that it is an underbalanced drilling method, aiming to continuously underbalance the formation pressure.

Moreover, even if the skilled person were to consider the use of a RCH/RBOP to solve the above defined problem, he would immediately realise that such a device would prevent the method of D1 from functioning properly. Indeed, the skilled person would most probably replace BOP 11 of D1 with a RCH/RBOP, and this would prevent any drilling fluid from entering into the riser 13 from the wellbore 5. Thus, the drilling fluid would not be discharged in the branch conduit 38 and the method of D1 would no longer function.

For these reasons, the skilled person would not use a RCH/RBOP in the method of D1.

6.2.9 Appellant II further argued that the skilled person would inevitably arrive at a control system having the combination of features (b) and (n) to (t) if he sought

to replace the manual control of the back pressure in D1 by an automatic control. The Board does not share this view as substantial modifications would be required, e.g. the provision of mass and fluid flow meters, software to predict the expected outflow and to compare it to the actual outflow, a pressure/flow control device etc.: such modifications are not obvious.

6.2.10 Thus, starting from D1, the claimed invention involves an inventive step in the sense of Article 56 EPC.

6.3 Claim 1 - Inventive step vs. D2

6.3.1 D2 discloses a method/system for drilling a well in either an underbalanced or an overbalanced pressure condition (see e.g. claim 1). D2 discloses two distinct embodiments of this method, namely that of Figures 1 to 6 and that of Figure 7. These embodiments differ significantly and thus must be considered separately.

6.3.2 Figures 1 to 6 of D2 disclose an embodiment in which the well is closed and drilling is carried out with natural gas, preferably in an underbalanced pressure condition (column 7, lines 8 and 9). This embodiment does not disclose features (e), (g), (l) and (m) and, at least partly, features (c), (h) and (j) of claim 1.

6.3.3 According to the embodiment shown in Figure 7 of D2, the well is kept open and drilling is carried out with a drilling fluid, such as a conventional drilling mud (column 11, lines 40 to 44). A conventional BOP 38 is provided at the top of the wellbore. In contrast to the embodiment of Figures 1 to 6, a ROBP is not used (column 11, lines 44 to 45). Instead, the inflow rate and the outflow rate are monitored to check any

discrepancy, thereby allowing detection of a kick followed by an alarm signal for the operator.

6.3.4 Contrary to the method of Figures 1 to 6, that of Figure 7 is directed to a similar purpose or effect as the claimed invention, namely to detect early an unexpected kick while drilling in overbalanced pressure condition. The method of Figure 7 also requires far less structural and functional modifications to arrive at the claimed invention. In particular, in Figure 7, the kick is detected by monitoring the inflow and outflow rates, as in the invention. Thus, compared to Figures 1 to 6, Figure 7 is a more promising starting point to arrive at the claimed invention.

6.3.5 The Board agrees with Appellant II that the method of claim 1 is distinguished from the embodiment of Figure 7 *inter alia* by features (a), (b) and (n) to (t) and in that "the well is kept closed with a pressure containment device at all times" while actively drilling (preamble of claim 1). The control valves 53a and 53b in Figure 7 do not keep a back pressure on the well, since it is not closed (feature (b)). The controller 344 of Figure 7 takes account of actual flow signals and an actual pressure signal (column 12, lines 4 to 19), not of actual and predicted outflow signals (feature (n)). The controller 344 compares the actual inflow to the actual outflow, not the actual outflow to a predicted outflow (features (q), (o), (s)). The controller 344 does not comprise software predicting an ideal outflow and acting on the principle of mass conservation (features (r) and (s)). The controller 344 does not restore a predicted outflow rate (feature (t)).

- 6.3.6 Starting from Figure 7 of D2, the objective problem to be solved could be formulated as when starting from D1, i.e. to improve the detection and control of kicks.
- 6.3.7 The claimed solution to this problem was not part of common general knowledge and is neither disclosed nor suggested in D3 and D4.
- 6.3.8 Regarding common general knowledge and D3, the reasons given in points 6.2.7 to 6.2.9 above apply.
- 6.3.9 With respect to D4, Appellant I argued essentially that a skilled person aiming to control drilling would be taught by D4 to include features (o), (p), (t) and (s). The Board disagrees. D4 discloses a conventional overbalanced drilling method, with the annulus open to the atmosphere while drilling (column 2, lines 1 to 5). A conventional BOP 12 is maintained in an open position, except during an impending kick (column 1, line 74 to column 2, line 6). Flow meters 15 and 16 measure the mud flow in and out of the well. When a kick is impending, a flow differential is created within the alarm system 21 by comparing the signals received from the flow meters 15 and 16 (column 2, lines 37 to 42). Upon activation of the alarm system 21, signals set the mud pump 8 at a predetermined rate to lift the kelly joint (i.e. to stop drilling), to close BOP 12 and to increase the mud weight to kill the kick (column 2, lines 42 to 56; column 3). Thus, the flow of mud is controlled only while killing a kick (column 4, lines 14 to 17), not while actively drilling the well. Hence, D4 neither teaches that the well is kept closed with a pressure containment device at all times while actively drilling (preamble of claim 1) nor does it disclose features (a), (b) and (n) to (t).

- 6.3.10 Hence, starting from Figure 7 of D2, the claimed invention involves an inventive step.
- 6.3.11 The same conclusion would be reached if the skilled person were to start from the drilling method in Figures 1 to 6 of D2. In particular, this drilling method is not compatible with conventional overbalanced drilling methods as disclosed in D1 and D4 and at least features (b) and (n) to (t) are neither disclosed nor suggested in D1 and D4.
7. The Board therefore agrees with the opposition division that the subject-matter of claim 1 involves an inventive step when starting from either D1 or D2.
8. Other independent claims and dependent claims
- 8.1 Independent claims 28, 44, 45 and 54, as well as the dependent claims, have been adapted to claim 1. The amendments also fulfill the requirements of Articles 123(2) and 84 EPC for the reasons given above.
- 8.2 Appellant I contended that dependent claims 5, 7, 32 and 34 introduce a lack of clarity because the expressions "the equivalent circulating density" and "the ECD" lack an antecedent and these claims suggest that the method/system controls only the ECD and not the outflow, contrary to the teaching in independent claims 1 and 28. These arguments are not convincing. The expressions "equivalent circulating density" and "ECD" are well known in the art of well control. Claims 5, 7, 32 and 34 define preferred embodiments of the claimed method/system where, in addition to the outflow, the ECD is controlled. This has been expressly acknowledged by Appellant II during the oral proceedings.

8.3 Appellant I contended that dependent claim 43 lacks clarity because it defines "three safety barriers, the drilling fluid, a blow-out preventer equipment and the pressure containment device", even though it is already implicit from independent claim 28 that the drilling fluid provides a safety barrier. This argument is not convincing. Claim 43 describes a preferred embodiment of the system of claim 28, which already has two safety barriers during drilling, namely "the drilling fluid" and "the pressure containment device" closed at all times. Thus, claim 43 simply defines a third safety barrier in the form of "a blow-out preventer equipment", whereby it is implicit that it can be closed as a safety measure in case of any uncontrolled kick occurring (in the patent specification see paragraph [0041] and the illustrated embodiments with pressure containment device 26 and BOP 8 which "remains open during drilling"; see also paragraph [0160]). This has been expressly acknowledged by Appellant II during the oral proceedings.

8.4 The above reasoning with respect to the inventive step of claim 1 applies *mutatis mutandis* to the other independent claims and the dependent claims.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to maintain the patent on the basis of the following claims and a description and drawings to be adapted thereto:
 - claims 1 to 54 according to Annex 2 filed during the oral proceedings.

The Registrar:

The Chairman:



C. Spira

G. Ashley

Decision electronically authenticated