Paper No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

OMRON OILFIELD & MARINE, INC.
Petitioner

v.

MD/TOTCO, A DIVISION OF VARCO, L.P.
Patent Owner

Patent No. 5,474,142
Issue Date: December 12, 1995
Title: AUTOMATIC DRILLING SYSTEM

Inter Partes Review No. Unassigned

PETITION FOR *INTER PARTES* REVIEW UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.100 *ET. SEQ.*

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NOTICE OF LEAD AND BACKUP COUNSEL

Lead Counsel: Matthew B. Lowrie (Reg. No. 38,228); Tel: (617) 342-4006

Address: Foley & Lardner LLP, 111 Huntington Avenue, Suite 2500
Boston, MA 02199, FAX: (617) 342-4001

Backup Counsel: Kimberly K. Dodd (Reg. No. 54,646); Tel: 414-319-7345

Address: Foley & Lardner LLP, 777 East Wisconsin Avenue
Milwaukee WI 53045, FAX: (414) 297-4900

NOTICE OF EACH REAL PARTY-IN-INTEREST

The real party-in-interest for this Petition is Omron Oilfield & Marine, Inc.

NOTICE OF RELATED MATTERS

U.S. Patent No. 5,474,142 ("the '142 patent") has been asserted in the following actions: *National Oilwell Varco, LP v. Omron Oilfield & Marine, Inc.* (W.D. Tex. Case No. 12-cv-00773) (filed 8/23/12, still pending); *National Oilwell Varco, LP v. Pason Sys. USA, Corporation* (W.D. Tex. Case No. 12-cv-01113) (filed 12/7/12, still pending); *National Oilwell Varco, LP v. Pason Sys. USA Corp.* (D. Colo. Case No. 03-cv-02579; Fed. Cir. Case Nos. 2012-1551, -1587) (appeal pending); *Bowden v. Tech Power Controls* (S.D. Tex. Case No. 00-cv-00271) (dismissed before claim construction); *Bowden v. Martin-Decker Totco* (W.D. Tex. Case No. 99-cv-00607) (dismissed before claim construction); *Varco LP v. IDM Equip. Co. Inc.* (S.D. Tex. Case No. 05-cv-00767) (dismissed before claim construction); *National Oilwell Varco, LP v. Auto-Dril, Inc.* (E.D. Tex. Case No.

09-cv-00085) (dismissed after claim construction).

The Federal Circuit addressed certain claim construction issues on appeal from the District of Colorado's denial of preliminary injunction in Case No. 03-cv-02579 listed above. (*See* Ex. 1002.) On remand, the District of Colorado issued an initial claim construction order (*see* Ex. 1003), and later construed additional claim terms (*see* Ex. 1004 (excerpt of the trial transcript with the claim constructions as read to the jury)). The Eastern District of Texas issued a claim construction order in Case No. 09-cv-00085 listed above. (*See* Ex. 1005.)

NOTICE OF SERVICE INFORMATION

Please address all correspondence to the lead counsel at the address shown above. Petitioner also consents to electronic service by email at:

mlowrie@foley.com

GROUNDS FOR STANDING

Petitioner hereby certifies that the patent for which review is sought is available for *inter partes* review and that the Petitioner is not barred or estopped from requesting an *inter partes* review challenging the patent claims on the grounds identified in the petition.

STATEMENT OF PRECISE RELIEF REQUESTED

The Petitioner respectfully requests that claims 1, 11 and 14 of U.S. Patent No. 5,474,142 ("the '142 patent") (Ex. 1001) be canceled based on the following

grounds of invalidity, explained in detail (including relevant claim constructions) in the next section:

Ground 1. Claims 1, 11, and 14 are invalid under 35 U.S.C. § 102(b) over Lindstad.

Ground 2. Claims 1, 11, and 14 are invalid under 35 U.S.C. § 103(a) over Lindstad and Crake.

Ground 3. Claims 1, 11, and 14 are invalid under 35 U.S.C. § 103(a) over Lindstad and Brooks.

Ground 4. Claims 1, 11, and 14 are invalid under 35 U.S.C. § 102(b) over Warren.

Ground 5. Claims 1, 11, and 14 are invalid under 35 U.S.C. § 103(a) over Warren and Brooks.

Ground 6. Claims 1 and 11 are invalid under 35 U.S.C. § 102(b) over Miller.

Ground 7. Claim 14 is invalid under 35 U.S.C. § 103(a) over Miller and Crake.

Ground 8. Claim 14 is invalid under 35 U.S.C. § 103(a) over Le Compte and Crake.

THRESHOLD REQUIREMENT FOR *INTER PARTES* REVIEW

A petition for *inter partes* review must demonstrate "a reasonable likelihood

that the Petitioner would prevail with respect to at least one of the claims challenged in the petition." 35 U.S.C. § 314(a). The Petition meets this threshold. All elements of claims 1, 11 and 14 of the '142 patent are taught in the prior art as explained below in the proposed grounds of invalidity, and reasons to combine are established for each ground under 35 U.S.C. § 103(a).

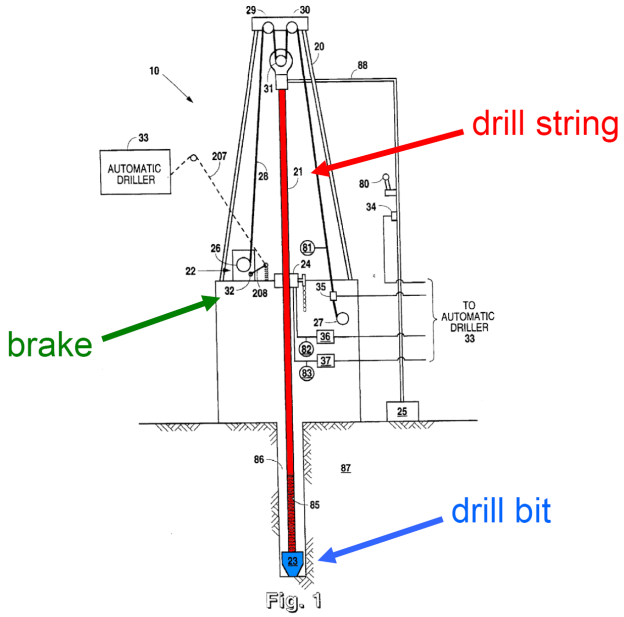
STATEMENT OF REASONS FOR RELIEF REQUESTED

I. Technical Introduction

A. The Disclosure of the '142 Patent

The '142 patent relates to a driller that regulates the release of the drill string in response to four drilling parameters: bit weight (also called weight on bit), fluid pressure, torque, and RPM. ('142 patent, Ex. 1001, Abstract.) Only two of the parameters – bit weight and fluid pressure – are relevant to the claims that are the subject of this Petition (claims 1, 11 and 14).

Figure 1 of the '142 patent depicts the basic components of a drilling rig. The drill string 21 extends into the borehole 86 utilizing drawworks 22. (*Id.* 3:55-56.) A brake 32 controls the release of cable 28 to adjust the vertical position of the drill string 21. (*Id.* 3:61-63.) A



drill bit 23 is located at the end of the drill string 21. (*Id.* 3:65-66.) A rotary table 24 drives the drill string 21 to rotate the drill bit 23 to achieve the drilling of the borehole. (*Id.*) Drilling fluid (such as mud) is pumped into the drill string 21 and "drives mud motor 85, provides pressure within drill bit 23 to prevent blowouts, and carries drilled formation materials from borehole 86." (*Id.* 4:10-25.)

The object of the invention is to maintain "sufficient and constant pressure" on the drill bit to achieve optimal rate of penetration. (*Id.* 4:16-32.) For example, the drill bit may rise "off bottom," i.e., off the bottom of the borehole, causing the progression of drilling to cease (where the drill bit is spinning, but not at the bottom of the hole). (*Id.*) In that situation, the release of the drill string is adjusted to maintain the drill bit "on bottom." (*Id.*)

The '142 patent acknowledges that it was common in the prior art to measure the bit weight and automatically regulate the release of the drill string to maintain optimal bit weight. (*Id.* 1:14-15.) The '142 patent discloses the purportedly novel concept of automatically regulating the release of the drill string based other parameters in addition to bit weight, including drilling fluid pressure, torque, and RPM. (*Id.* 1:14-2:3.)

The driller of the '142 patent achieves the automatic regulation of the drill string through the use of four regulators in series, one regulator for each of the four drilling parameters. (*Id.* 7:17-8:6.) The regulators, which are pneumatic valves,

are depicted in Figure 2 of the patent. (*Id.* 3:9-11; Fig. 2.)

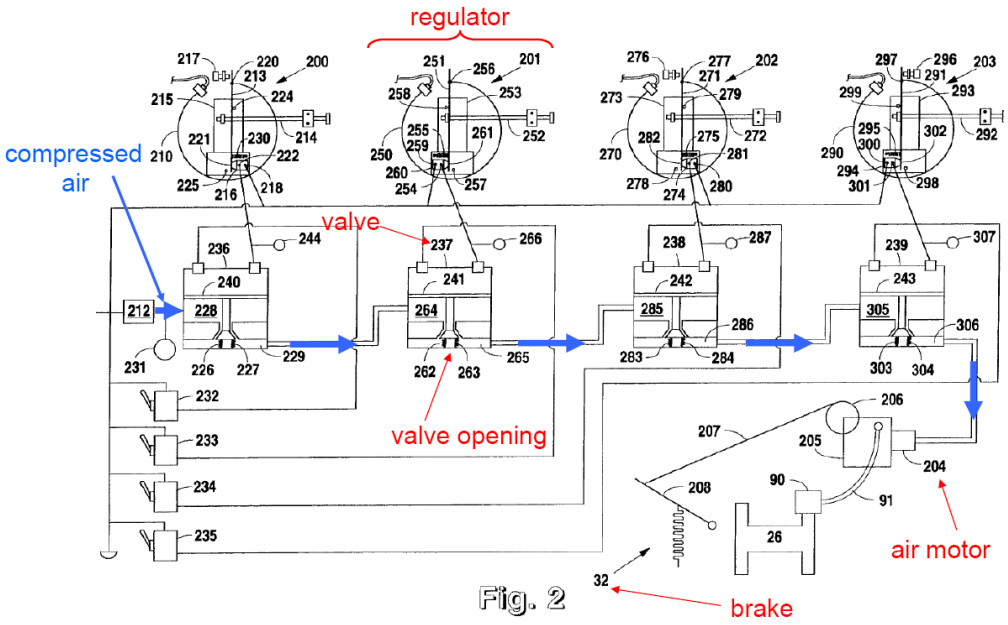


Fig. 2

The use of the regulators can be summarized as follows: The valves control the amount of air that is fed to the air motor 204, the air motor controls the brake 32 and therefore the rate of release of the drill string. (*Id.* 7:35-8:61; 10:4-32.) As a result, the amount that the valve is held open dictates how much braking force is applied. (*Id.*) If the valve is completely shut, no air is fed to the motor, which prevents the motor from lifting the brake and the release of the drill string is completely stopped. (*Id.*) On the other hand, if the valve is fully open, the air motor lifts the brake and the release is faster. (*Id.*)

The magnitude of the valve opening is determined by a sensor for the applicable parameter, e.g., a drilling fluid pressure sensor. (*Id.*) Before drilling begins, the operator manually adjusts a screw on each regulator to open the valve a

desired amount. (*Id.* 8:52-10:32.) Once drilling commences, a decrease in drilling fluid pressure below the desired level will cause the valve to open to a greater degree, which will increase the amount of air delivered to the air motor and a release of the brake. (*Id.* 10:4-32.) As the drilling fluid pressure increases, the reverse occurs. (*Id.* 10:33-61.)

B. The Use of Drilling Fluid Pressure as the Control Parameter is the Only Purportedly Novel Aspect of the Subject Claims

As the '142 patent acknowledges, the use of bit weight measurements to automatically regulate the release of a drill string was not new. ('142 patent, Ex. 1001, 1:14-35.) In fact, the father of the '142 patent inventor had a patent for a drilling system that automatically regulated the release of the drill string based on bit weight – U.S. Patent No. 3,265,359, which issued on August 9, 1966 ("the 1966 Bowden patent") (Ex. 1006).

The 1966 Bowden patent is very similar to the '142 patent. Just like the '142 patent, the 1966 Bowden patent discloses that bit weight can be measured by measuring the tension of the cable. (Compare '142 patent, Ex. 1001, 6:12-25 & Fig. 7 with the 1966 Bowden patent, Ex. 1006, 3:49-62 & Fig. 4.) Just like the '142 patent, the 1966 Bowden patent discloses that the changes in bit weight cause a diaphragm to deflect, which causes a change pressure in a hydraulic fluid line. (Compare '142 patent, Ex. 1001, 6:17-25 with the 1966 Bowden patent, Ex. 1006,

3:64-75.) Just like the ’142 patent, the 1966 Bowden patent discloses that the changes in pressure in the hydraulic fluid line causes the opening of a diaphragm valve to increase or decrease. (Compare ’142 patent, Ex. 1001, 13:23-38 with the 1966 Bowden patent, Ex. 1006, 4:1-17.) Just like the ’142 patent, the 1966 Bowden patent discloses that the diaphragm valve dictates the amount of fluid is permitted to reach a fluid motor. (Compare ’142 patent, Ex. 1001, 13:39-41 with the 1966 Bowden patent, Ex. 1006, 4:17-20.) And just like the ’142 patent, the 1966 Bowden patent discloses that the fluid motor controls the brake, and thus controls the release of the drill string. (Compare ’142 patent, Ex. 1001, 13:41-47 with the 1966 Bowden patent, Ex. 1006, 4:21-38.)

The close similarities between the ’142 patent and the 1966 Bowden patent demonstrate that the components of the ’142 patent were not new. Accordingly, the only purportedly novel aspect of the subject claims was the use of drilling fluid pressure as an additional parameter to control the release of the drill string.

C. The Use of Drilling Fluid Pressure to Control the Release of the Drill String Was Not New

Contrary to the ’142 patent specification, the use of drilling fluid pressure as a control parameter to automatically regulated the release of the drill string was *not new*. This Petition discusses three prior art references not previously considered during the prosecution and reexaminations of the ’142 patent that disclose the use

of drilling fluid pressure to control the release of the drill string – Lindstad, Warren, and Miller. Lindstad and Warren each anticipate all of the subject claims. Miller anticipates claims 1 and 11.

But even if these prior art references do not disclose each and every element of the subject claims, the claims are nonetheless obvious. In *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415 (2007), the Supreme Court emphasized "the need for caution in granting a patent based on the combination of elements found in the prior art." When considering obviousness of a combination of known elements, the operative question is "whether the improvement is more than the predictable use of prior art elements according to their established functions." *Id.* at 417. The subject claims merely recite an apparatus and methods of employing elements present in the prior art to produce predictable results.

During the second reexamination of the '142 patent, the Examiner rejected the subject claims as obvious based on a combination of the 1966 Bowden patent with two other prior art references (Hobhouse and Dillon). The Examiner never retreated from his position that the claims are *prima facie* obvious based on this combination. (3/27/10 Office Action, Ex. 1007, p. 2.) Instead, he found that the Patent Owner's showing of secondary considerations overcame the obviousness rejection. (*Id.*)

This Petition presents prior art that was not considered during the

prosecution of the ’142 patent and the two reexaminations. The Patent Owner’s evidence of secondary considerations will be unable to overcome the strong showing of obviousness set forth in this Petition. *Sibia Neurosciences v. Cadus Pharmaceutical*, 225 F.3d 1349, 1358 (Fed. Cir. 2000) (evidence of secondary considerations does not overcome a strong case of obviousness).

II. Construction of the Claims

Claim construction of the ’142 patent is governed by the principles set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316 (Fed. Cir. 2005) because the patent expired on April 19, 2013. As background, the Board’s attention is directed to the previous claim construction rulings involving the ’142 patent mentioned above. (*See* Exs. 1002-1005.) In the current litigation against Petitioner in the Western District of Texas, the Patent Owner argues that very few of the claim terms require construction. (*See* Ex. 1008.)

A. Claims 1, 11 and 14 – Construction of “drilling fluid”

Claims 1, 11 and 14 recite measuring “drilling fluid pressure.” “Drilling fluid” should be construed as “fluid, such as air, gas, water, or mud, that is pumped down the drill string.” Although the ’142 patent specification describes the use of mud as the drilling fluid in conjunction with the disclosed embodiments, it is and was common in drilling to use other types of drilling fluid, such as air, gas, and water.

Petitioner's proposed construction of "drilling fluid" is consistent with the definition the Patent Owner submitted in the District of Colorado case, which was from "A Dictionary for the Oil and Gas Industry" published by the University of Texas at Austin Petroleum Extension Service ("PETEX") in 2005 ("2005 PETEX Dictionary"):

> **drilling fluid** – circulating fluid, one function of which is to lift cuttings out of the wellbore and to the surface. It also serves to cool the bit and to counteract downhole formation pressure. Although a mixture of barite, clay, water and other chemical additives is the most common drilling fluid, wells can also be drilled using air, gas, water, or oil-based mud as the drilling mud. Also called circulating fluid, drilling mud.

(*See* Markman Br., Ex. 1009, pp. 26-27; 2005 PETEX Dictionary, Ex. 1010, p. 78.) This definition is almost identical to a dictionary published in 1991 by PETEX, which pre-dates the '142 patent. (1991 PETEX Dictionary, Ex. 1011, p. 82.)

B. Claim 14 – Construction of "bit weight"

Claim 14 recites measuring "bit weight." The term "bit weight" should be construed as "the amount of weight or force that the drill string applies to the drill bit." "Bit weight" is used interchangeably in the '142 patent with "weight on bit": "FIGS. 7 and 8 illustrate two standard ***weight on bit*** sensors . . . . In FIG. 8, a Martin-Decker anchor weight indicator implements a ***bit weight*** sensor 35 to

provide the hydraulic signal to automatic driller 33 representing the weight drill string applies to drill bit 23." ('142 patent, Ex. 1001, 6:12-36 (emphasis added).)

Petitioner's proposed construction is consistent with the above passage and the definition the Patent Owner submitted in the District of Colorado case, which was from the 2005 PETEX dictionary: "weight on bit (WOB) *n*: the amount of downward force placed on the bit by the weight of the drill [string]." (Markman Br., Ex. 1009, p. 65; 2005 PETEX Dictionary, Ex. 1010, p. 299.) This is the same definition from the 1991 PETEX Dictionary, which pre-dates the '142 patent. (1991 PETEX Dictionary, Ex. 1011, p. 304.)

C. Claims 1, 11, and 14 – Construction of "release of [the] drill string"

Claims 1, 11, and 14 recite the "release of [the] drill string." This term should be construed as "the downward movement of the drill string into the borehole."

The '142 patent does not define this term. (*See generally* '142 patent, Ex. 1001.) The Patent Owner may argue for a narrow construction that limits "release" to downward movement via the pull of gravity because that is how many oilwell rigs operate. Such a narrow construction should be rejected because the patent specification does not indicate an exclusion of other methods of downward movement, such as use of motor to apply a downward force.

D. Claim 1 – Construction of "drilling fluid pressure regulator"

The "drilling fluid pressure regulator" recited in claim 1 is a device that measures changes in drilling fluid pressure and produces an output signal representative of any changes. (*See* '142 patent, Ex. 1001, 2:4-6 ("The regulators receive their respective signals to measure changes in those signals and produce an output signal representative of any changes.").)

III. Claim-By-Claim Explanation of Grounds for Invalidity

Claims 1, 11 and 14 are invalid as shown in the following Grounds. The grounds for invalidity are supported by the testimony of Mitchell Pinckard, who provides testimony regarding the prior art and the understanding of one of ordinary skill in the art. Mr. Pinckard's declaration is attached as Exhibit 1012. The grounds of invalidity are discussed in detail below.

Ground 1: Claims 1, 11, and 14 are invalid under 35 U.S.C. § 102(b) over Lindstad.

Claims 1, 11, and 14 are invalid under 35 U.S.C. § 102(b) over U.S. Patent No. 3,613,805 to Lindstad ("Lindstad") (Ex. 1013). Lindstad issued on October 19, 1971.

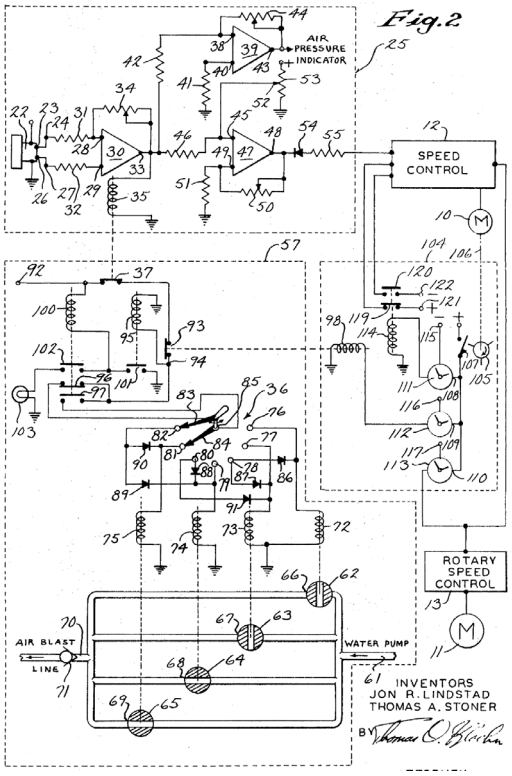
Lindstad discloses a blasthole drilling system that automatically regulates the release of the drill string in response to changes in drilling fluid pressure. (Lindstad, Ex. 1013, 2:6-35; 2:55-65; 4:5-5:8; claims 4-5.) Lindstad discloses that the drill string is controlled by a downfeed control that was disclosed in a then co-

pending application filed by the same assignee (with a common inventor), 854,871, which issued as U.S. Patent No. 3,581,830 to Stoner ("Stoner") (Ex. 1014). (Lindstad, Ex. 1013, 3:45-53.) Lindstad incorporates the disclosure of Stoner by reference. (*Id.*; *see also* Abstract.) "'Material not explicitly contained in the single, prior art document may still be considered for purposes of anticipation of that material is incorporated by reference into the document.'" *Callaway Golf Co. v. Acushnet Co.*, 576 F.3d 1331, 1346 (Fed. Cir. 2009) (citing *Advanced Display Sys., Inc. v. Kent State Univ.*, 212 F.3d 1272, 1283 (Fed. Cir. 2000)). Similar to the patent in *Callaway*, Lindstad incorporates the entire Stoner patent by reference. *Id.* (the Nesbitt patent incorporated the entire Molitor patent by reference). Stoner discloses a blasthole drilling system that automatically regulates the release of the drill string in response to changes in the amount of force on the drill bit (i.e., the "bit weight"). (Stoner, Ex. 1014, 9:42-49.)

Lindstad: Lindstad discloses an automatic blasthole drilling rig with a drill 8 (the "drill string") and drill bit 9. (Lindstad, Ex. 1013, 3:23-44; Fig. 1.) The drill 8 is driven into the earth by a downfeed drive motor 10. (*Id.*) The downfeed drive motor 10 is controlled by the downfeed control disclosed in Stoner. (*Id.* 3:45-67.)

Lindstad discloses that drilling fluid in the form of compressed air is forced through the hollow drill 8 and out holes in the drill bit 9. (*Id.* 3:69-4:4.) The air pressure is measured using an air pressure sensor 22. (*Id.* 4:5-17; Fig. 1.) The air

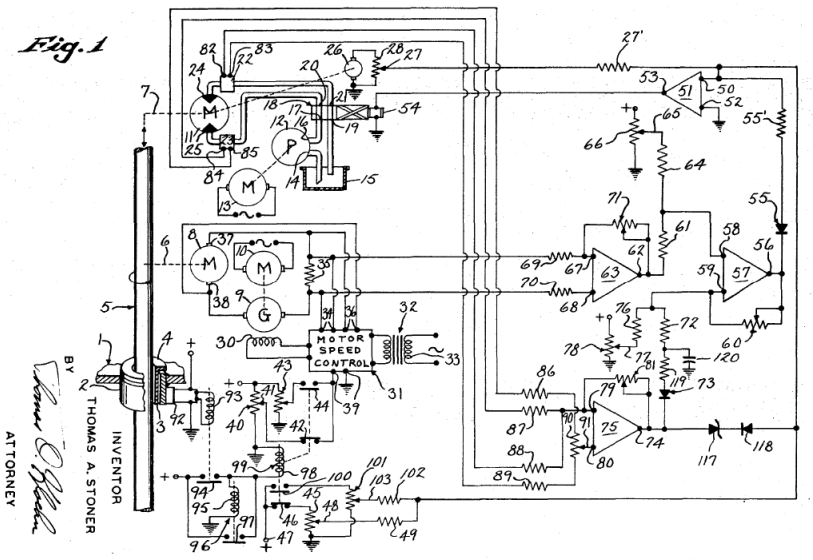
pressure sensor 22 is connected to an air pressure monitor 25. (*Id.*; Fig. 2.) The air pressure monitor 25 generates signals in the form of voltage representing changes in air pressure, which are passed to the downfeed speed control 12 that controls the downfeed drive motor 10 of the drill 8. (*Id.* 4:5-5:8.)



During normal drilling conditions, the air pressure monitor 25 generates a signal in the form of positive voltage. (*Id.* 4:48-5:8.) A blocking diode 54 within the air pressure monitor 25 blocks the positive voltage, resulting in no current flow to the downfeed speed control 12 and, thus, no change in the release of the drill string. (*Id.*) As the air pressure increases, a proportionately increasing negative current is generated by the air pressure monitor 25. (*Id.*) The blocking diode conducts the current to the downfeed speed control 12. (*Id.*) The negative current is subtracted from the positive reference current in the downfeed speed control, thus slowing the downfeed drive motor 10 (or reversing it). (*Id.*) When the air pressure returns to a safe level, the normal drilling speed of the downfeed motor 10 resumes. (*Id.* 2:54-75.)

Stoner (Incorporate Into Lindstad By Reference): Stoner discloses that the

"downfeed control" incorporated into Lindstad also automatically regulates the rate of release of the drill string in response to changes in the force on the drill bit (the "bit weight"). (Stoner, Ex. 1014, 9:42-49.) As in Lindstad, Stoner discloses that the drill stem 5 (the "drill string") is driven into the earth by a motor 11. (*Id.* 3:9-13.) The motor 11 "is powered by a pump 12 that is driven by another AC motor 13 that is also connected across an AC source." (*Id.*) Together, this "downfeed drive means" exerts downfeed pressure on the drill stem (also called the tool 5) including "100 to 200 p.s.i. from the dead weight of the tool 5 plus 0 to 1,000 p.s.i. applied by the downfeed drive means." (*Id.* 3:1-4.)



The amount and direction of force applied by the downfeed drive means on the drill stem 5 is measured by pressure sensors 22 and 23 on the motor 11. (*Id.* 5:8-21.) Each pressure sensor has an electrical bridge that generates signals representing the direction and magnitude of the linear force. (*Id.* 5:8-21.) When the linear force (the "bit weight") becomes excessive, a feedback signal (in the form of negative voltage) is transmitted to servo valve amplifier 51, which

"reduces or reverses the feed until the conditions causing the excessive load on the linear drive is corrected or the feedrate is reduced by the operator." (*Id.* 9:42-49.)

Claims 1, 11 and 14 of the '142 patent are mapped to the disclosures of Lindstad (and Stoner) in the following claim chart.

[1a] 1. An automatic drilling system for automatically regulating the release of the drill string of a drilling rig having a drill bit in association therewith during the drilling of a borehole, comprising:	Lindstad discloses a drilling system that automatically regulates the release (the downward movement) of the drill string in response to changes in air pressure (the "drilling fluid"). (Lindstad, Ex. 1013, 2:6-35; 2:55-65; 4:5-5:8; claims 4-5; Pinckard Decl., Ex. 1012, ¶ 18.) The drilling rig disclosed in Lindstad has a drill bit 9 in association therewith. (Lindstad, Ex. 1013, 3:30-32; Fig. 1; Pinckard Decl., Ex. 1012, ¶ 19.)
[1b] a drilling fluid pressure sensor;	Lindstad discloses a drilling system that uses air as the drilling fluid: "During drilling the drill cuttings must be removed from the hole. This is presently accomplished by pumping compressed air through the hollow drill stem and out of holes in the bit, so that the resulting airblast blows the cuttings out of the hole." (Lindstad, Ex. 1013, 1:27-40; Pinckard Decl., Ex. 1012, ¶ 20.) An air pressure sensor 22 measures the air pressure: "An air pressure sensor 22 is connected to the air conduit 16 and its output terminals 23 and 26 are respectively connected to a pair of input terminals 24 and 27 of the air pressure monitor 25, which is also located inside the machinery housing 4." (Lindstad, Ex. 1013, 4:5-17; *see also id.* 2:5-34; 2:54-75; claims 4-5; Figs. 1-2; Pinckard Decl., Ex. 1012, ¶ 21.)
[1c] a drilling fluid pressure regulator coupled to said drilling fluid pressure sensor, said drilling fluid pressure regulator measuring changes in	Lindstad discloses that the air pressure sensor 22 is coupled to an air pressure monitor 25, which is a "drilling fluid pressure regulator." (Lindstad, Ex. 1013, 4:5-17 & Fig. 2; claims 4-5; Pinckard Decl., Ex. 1012, ¶ 22.) The air pressure monitor 25 is depicted in Figure 2: "An air pressure sensor 22 is connected to the air conduit 16 and its output terminals 23 and 26 are

drilling fluid pressure and outputting a signal representing those changes;	respectively connected to a pair of input terminals 24 and 27 of the air pressure monitor 25, which is also located inside the machinery housing 4." (*Id.*) The air pressure monitor outputs a signal representing changes in drilling fluid pressure in the form of negative current such that the amount of change is indicated by the amount of negative current. (Lindstad, Ex. 1013, 4:5-5:8; Pinckard Decl., Ex. 1012, ¶ 24.)
[1d] a relay coupled to said drilling fluid pressure regulator, said relay responsive to the output signal of said drilling fluid pressure regulator to supply a drill string control signal at an output thereof; and	Lindstad discloses that the signal representing changes in drilling fluid pressure is transmitted to the speed control 12 via a coupling resistor 55, which is a "relay." (Lindstad, Ex. 1013, 4:59-5:8; Fig. 2; Pinckard Decl., Ex. 1012, ¶ 25.) The coupling resistor 55 is coupled to the air pressure monitor 25 (the "drilling fluid pressure regulator"). (*Id.*) The signal is a "drill string control signal" because it controls the downfeed drive motor 10 that regulates the release of the drill string: "When a negative voltage appears at the output terminal 48 of the air pressure feedback amplifier 47, the blocking diode 54 conducts and the current subtracts from the preset positive reference current in the downfeed speed control 12 thus slowing the downfeed drive motor 10, or reversing it, if the output 48 swings sufficiently negative. During normal drilling, the positive bias current on noninverting input terminal 45 of the air pressure feedback amplifier 47 will produce a positive signal at the output terminal 48, which is blocked by the blocking diode 54, resulting in no current flow to the linear speed control 12. As the air pressure in the airline increases, a proportionately increasing negative current is transmitted from the output terminal 33 of the air pressure sensor amplifier 30 to the noninverting input terminal 45 of the air pressure feedback amplifier 47. When this negative current equals the positive bias current, the output terminal 48 will swing negative and the downfeed rate will begin to decelerate." (Lindstad, Ex. 1013, 4:63-5:4; *see also* claims 4-5; Pinckard Decl., Ex. 1012, ¶¶ 25-27.)
[1e] a drill string	Lindstad discloses that the speed control 12 controls the

controller coupled to said relay wherein a decrease in drilling fluid pressure results in said relay supplying a drill string control signal that operates said drill string controller to effect an increase in the rate of release of said drill string with direct effect at the drill bit associated with the drill string and an increase in drilling fluid pressure results in said relay supplying a drill string control signal that operates said drill string controller to effect a decrease in the rate of release of said drill string with direct effect at the drill bit associated with the drill string.	speed of the downfeed drive motor 10 that controls the rate of release of the drill string. (Lindstad, Ex. 1013, 4:63-5:8; Pinckard Decl., Ex. 1012, ¶¶ 25-27.) An increase in air pressure causes the downfeed rate to decelerate as discussed above in [1d]. (Lindstad, Ex. 1013, 4:63-5:8, 2:6-35; 2:55-75, claims 4-5; Pinckard Decl. ¶¶ 25-27.) A decrease in air pressure causes the downfeed rate to increase: "When the pressure drops to a safe level, the normal drilling and water injection is automatically resumed." (Lindstad, Ex. 1013, 2:55-75; Pinckard Decl., Ex. 1012, ¶ 26.) This causes a "direct effect" at the drill bit because the drill bit is attached to the bottom of the drill string and moves with the drill string. (Lindstad, Ex. 1013, Fig. 1; Pinckard Decl., Ex. 1012, ¶ 28.)
[11a] 11. A method for automatically regulating the release of the drill string of a drilling rig drill having a drill bit in association therewith, comprising the steps of:	Linstad discloses the elements of the preamble for the reasons explained in [1a] above.
[11b] measuring drilling fluid pressure;	Lindstad discloses the limitations of this step for the reasons explained in [1b] above.
[11c] producing a signal in response to changes in drilling fluid pressure, said signal representing the changes in drilling fluid pressure;	Lindstad discloses the limitations of this step for the reasons explained in [1c] above.

[11d] relaying said signal to a drill string controller; and	Lindstad discloses the limitations of this step for the reasons explained in [1d] above.
[11e] controlling said drill string controller to increase the rate of release of said drill string with direct effect at the drill bit associated with the drill string when said signal represents a decrease in drilling fluid pressure and to decrease the rate of release of said drill string with direct effect at the drill bit associated with the drill string when said signal represents an increase in drilling fluid pressure.	Lindstad discloses the limitations of this step for the reasons explained in [1e] above.
[14a] 14. A method for automatically regulating the release of the drill string of a drilling rig drill, comprising the steps of:	Lindstad discloses the elements of the preamble for the reasons explained in [1a] above. In addition, Stoner discloses a drilling system that automatically regulates the release of the drill string in response to changes in linear force (the "bit weight"). (Stoner, Ex. 1014, 9:42-49; Pinckard Decl., Ex. 1012, ¶ 29.) The drilling rig disclosed in Stoner has a drill bit in association therewith. (Stoner, Ex. 1014, 2:64-67; Pinckard Decl., Ex. 1012, ¶ 29.) Lindstad incorporates Stoner by reference. (Lindstad 3:45-54; Abstract.) In fact, Lindstad teaches that the preferred embodiment includes the downfeed control disclosed in Stoner: "Both the downfeed drive, including the motor 10 and the speed control 12, and the rotary drive, including the motor 11 and control 13 are conventional, commercially available units. In addition to those units the blasthole drill also includes a downfeed control which is disclosed in the copending

	U.S. Pat. Application of the same inventors and owned by the same assignee as this invention and entitled 'Linear Feed Control for a Rotary Tool,' filed on Sept. 3, 1969, Ser. No. 854,871, the disclosure of which is incorporated here by reference." (Lindstad, Ex. 1013, 3:45-54.)
[14b] measuring drilling fluid pressure and bit weight;	Lindstad discloses measuring drilling fluid pressure for the reasons explained in [1b] above. Stoner discloses that the linear drive motor 11 has pressure sensors 22 and 23 that measure the force exerted on the drill bit (i.e., the "bit weight"): "Each of the pressure sensors 22 and 23 contains a diaphragm (not shown) exposed to fluid pressure in the conduits on respective sides of the linear motor 11 between the linear motor 11 and the valve 18. Each of the pressure sensors 22 and 23 also contains an electrical bridge (not shown), at least one leg of which includes a strain gauge (not shown) mounted on the diaphragm. Hence, the bridges will originate a DC signal proportional to the deflections of the diaphragms and thus proportional to the pressure of the hydraulic fluid in the conduits at the ports 24 and 25 of the motor 11. Since feedback signals are taken from both sides of the motor 11, the feedback signals will represent by polarity the direction of linear force, and by signal magnitude the amount of that pressure or force of that feed." (Stoner, Ex. 1014, 5:8-21; 3:1-23; Fig. 1; Pinckard Decl., Ex. 1012, ¶ 31.)
[14c] producing a first signal in response to changes in drilling fluid pressure, said first signal representing the changes in drilling fluid pressure;	Lindstad discloses the limitations of this step for the reasons explained in [1c] above.
[14d] producing a second signal in response to changes in bit weight, said second signal representing the changes in bit weight;	Stoner discloses that each of the pressure sensors 22 and 23 has an electrical bridge that produces a DC signal in response to changes in the downward force on the drill bit (the "bit weight") as discussed above in element [14b]. "When there is no pressure drop across the hydraulic motor 11, the output signals from the

	pressure sensors 22 and 23 will chancel each other so that no feedback signal is seen by the linear force feedback amplifier 75. As a pressure drop builds up across the motor 11 during downfeed of the tool 5, a feedback signal is transmitted to the inverting input terminal 79 and noninverting input terminal 80 of the linear force feedback amplifier 75, resulting in a negative linear force feedback signal on the output terminal 74 of the linear force feedback amplifier 75, which feedback signal will be passed by the blocking diode 73 and transmitted to the inverting input terminal 59 of the comparator amplifier 57. If the tool 5 is withdrawn, a negative feedback signal will appear on the inverting input terminal 79 of the linear force feedback amplifier 75 resulting in a positive output signal on the output terminal 74, which positive signal will be blocked by the blocking diode 73." (Stoner, Ex. 1014, 5:27-40; Pinckard Decl., Ex. 1012, ¶ 32.) The linear force feedback signals are proportional to the force exerted by the linear drive motor 10 on the drill string. (Stoner, Ex. 1014, 1:75-2:1; Pinckard Decl., Ex. 1012, ¶ 32.) Thus, the amount of negative voltage indicates the changes in the downward force on the drill bit (the "bit weight"). (*Id.*; Stoner, Ex. 1014, 5:27-40.)
[14e] selecting any one of said first signal, said second signal, and both said first and said second signals to control the release of said drill string; and	By incorporating the downfeed control of Stoner by reference, Lindstad teaches a drilling system with a downfeed control that automatically regulates the release of the drill string in response to changes in both bit weight and drilling fluid pressure. (Pinckard Decl., Ex. 1012, ¶ 33.) When measuring the changes in these parameters in parallel, the downfeed control would necessarily "select" the drilling fluid pressure signal, the bit weight signal, or both to control the release of the drill string (as recited in claim 14). (*Id.*)
[14f] relaying said selected signal or signals to a drill string controller which regulates the release said drill string in	Lindstad discloses relaying the drilling fluid pressure signal to the drill string controller and regulating the release of the drill string in response to the signal (see [1d] and [1e] above). Stoner discloses relaying the bit weight signal to the drill string controller and

response to said selected signal or signals.	regulating the release of the drill string in response to the signal. Stoner discloses that when the linear force (the "bit weight") becomes excessive, a feedback signal (in the form of negative voltage) causes the downward movement of the drill string to be reduced or reversed: "A Zener diode 117 and a blocking diode 118, which are connected in series between the output terminal 74 of the linear force feedback amplifier 75 and the input terminal 50 of the servo valve amplifier 51, serve as a pressure limiter by providing a safety feedback signal when the load on the hydraulic motor 11 becomes excessive. Excessive loading on the linear drive will cause the output terminal 74 of the linear force feedback amplifier 75 to go negative and the Zener diode 117 to conduct driving the input terminal 50 of the servo valve amplifier 51 negative. This reduces or reverses the feed until the condition causing the excessive load on the linear drive is corrected or the feedrate is reduced by the operator." (Stoner, Ex. 1014, 9:37-49; Pinckard Decl., Ex. 1012, ¶ 34.) The servo amplifier 51 controls the linear drive motor 11, which controls the direction and rate of linear drive of the drill 5: "The servo valve amplifier 51 originates a control signal proportional to the error signal at its output terminal 53 which is connected to an electrical control 54 of the electrically controlled directional and flow control hydraulic valve 18 to actuate the valve 18 which controls the direction and rate of fluid flow to the linear drive motor 11 to control the direction and rate of linear drive of the tool 5." (Stoner, Ex. 1014, 4:13-21; Pinckard Decl., Ex. 1012, ¶ 35.)

Ground 2: Claims 1, 11, and 14 are invalid under § 103(a) over Lindstad and Crake.

If Lindstad does not anticipate claims 1, 11, and 14, then Lindstad renders these claims obvious under § 103(a) in combination with United States Patent No.

2,455,917 to Crake ("Crake") (Ex. 1015). Crake issued on December 14, 1948.

As discussed in the claim construction section above, the Patent Owner may argue for a narrow construction of "release" that is limited to the downward movement of the drill string via the pull of gravity. The Patent Owner may then argue that Lindstad fails to disclose regulation of the "release" of the drill string because the blasthole drill of Lindstad uses a motor to apply a downward force on the drill string. (Lindstad, Ex. 1013, 3:37-40.) If the Board adopts such a narrow construction of "release," claims 1, 11, and 14 are nonetheless invalid under § 103(a) over Lindstad and Crake.

Lindstad: Lindstad is explained above in conjunction with Ground 1.

Crake: Crake discloses a drilling system that automatically regulates the release of the drill string in response to changes in two drilling parameters: bit weight and the rate of penetration of the drill bit.

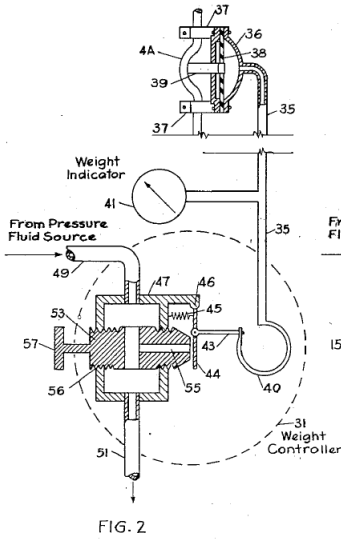


FIG. 2

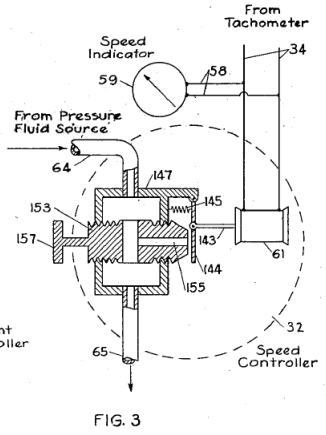


FIG. 3

(Crake, Ex. 1015, 1:1-6.) Crake discloses the use of a weight controller 31 and a speed controller 32 similar to the regulators of the '142 patent. (*Id.* Figs. 1-3; 3:22-75.) The controllers are used cooperatively to maintain the bit weight and penetration rate at desired limits. (*Id.* 6:27-39.)

The weight controller 31 measures bit weight using a weight-indicating device 36. (*Id.* 3:36-51.) If the bit weight gets too high, the weight controller causes fluid motor 28 to apply brake 19 to slow down the release of the drill string. (*Id.* 5:62-6:9.) If the bit weight gets too low, the reverse happens. (*Id.* 6:10-18.) The speed controller 32 controls the brake 119 in a similar fashion. (*Id.* 6:19-26.)

A combination of Lindstad and Crake would result in an oilwell drilling system that measures both bit weight and drilling fluid pressure, and automatically regulates the release of the drill string based on changes in these parameters.

Motivation to Combine: A person of ordinary skill in the art at the time of the '142 patent invention would have been motivated to combine the teachings of Lindstad and Crake. (Pinckard Decl., Ex. 1012, ¶ 38.) As discussed above, Crake teaches the automatic regulation of the drill string based on changes in bit weight. (*Id.*) But as acknowledged by the specification of the '142 patent, automatic drillers that use bit weight as the drilling parameter cease to operate properly for directional and horizontal drilling because the bit weight measurements are inaccurate when the drill string deviates from vertical. (*Id.*; '142 patent, Ex. 1001, 1:36-50.) During the second reexamination of the '142 patent, the Patent Owner argued that this constituted a long-felt, unresolved need. (12/14/09 Response, Ex. 1016, pp. 24-25.)

The teachings of Lindstad overcome this problem because measuring

drilling fluid pressure can indicate when the drill bit is "off bottom" regardless of whether the drill is vertical, directional, or horizontal. (Pinckard Decl., Ex. 1012, ¶ 38.) Accordingly, a person of ordinary skill would have been motivated to combine the teachings of a bit weight automatic driller (such as Crake) with the teachings of automatic driller that is effective for directional and horizontal drilling (such as Lindstad). (*Id.*)

Claims 1, 11 and 14 of the '142 patent are mapped to the disclosures of Lindstad and Crake in the following claim chart.

[1a] 1. An automatic drilling system for automatically regulating the release of the drill string of a drilling rig having a drill bit in association therewith during the drilling of a borehole, comprising:	Lindstad discloses the elements of the preamble for the reasons explained above in Ground 1. In addition, Crake discloses a drilling system that automatically regulates the release of the drill string in response to changes in bit weight and the rate of penetration of the drill bit. (Crake, Ex. 1015, 1:1-6; Pinckard Decl., Ex. 1012, ¶ 39.) The drilling rig disclosed in Crake has a drill bit in association therewith. (Crake, Ex. 1015, 2:42-45; Fig. 1; Pinckard Decl., Ex. 1012, ¶ 39.)
[1b] a drilling fluid pressure sensor;	Lindstad discloses this element for the reasons explained above in Ground 1.
[1c] a drilling fluid pressure regulator coupled to said drilling fluid pressure sensor, said drilling fluid pressure regulator measuring changes in drilling fluid pressure and outputting a signal representing those changes;	Lindstad discloses these limitations for the reasons explained above in Ground 1.
[1d] a relay coupled to	Lindstad discloses these limitations for the reasons

said drilling fluid pressure regulator, said relay responsive to the output signal of said drilling fluid pressure regulator to supply a drill string control signal at an output thereof; and	explained above in Ground 1.
[1e] a drill string controller coupled to said relay wherein a decrease in drilling fluid pressure results in said relay supplying a drill string control signal that operates said drill string controller to effect an increase in the rate of release of said drill string with direct effect at the drill bit associated with the drill string and an increase in drilling fluid pressure results in said relay supplying a drill string control signal that operates said drill string controller to effect a decrease in the rate of release of said drill string with direct effect at the drill bit associated with the drill string.	Lindstad discloses these limitations for the reasons explained above in Ground 1. In the event the Board adopts a narrow construction of the term "release" to exclude a drill with a motor that exerts a downward force on the drill string as in Lindstad, claim 1 would nonetheless be obvious over Lindstad and Crake. Crake discloses a drill that automatically regulates the release of the drill string in response to changes in bit weight and rate of penetration. (Crake, Ex. 1015, 1:1-6; Pinckard Decl., Ex. 1012, ¶ 44.) Crake discloses a drill for oilwell drilling. (*Id.*) There is no motor that exerts a downward force on the drill string. (*See generally* Crake, Ex. 1015; Pinckard Decl., Ex. 1012, ¶ 44.) Instead, the only force applied to the drill string is the weight of the drill string itself, similar to the '142 patent. (Crake, Ex. 1015, 2:46-55; Pinckard Decl., Ex. 1012, ¶ 44.) It would have been obvious to one of ordinary skill in the art at the time of the '142 invention to include a drilling fluid pressure controller to the control system of Crake based on the teachings of Lindstad. (Pinckard Decl., Ex. 1012, ¶ 44.) Based on the teachings of Lindstad, a drilling fluid pressure controller added to Crake would generate a drill string control signal wherein a decrease in drilling fluid pressure would cause an increase in the rate of release of the drill string and an increase in drilling fluid pressure would cause a decrease in the rate of release of the drill string. (*Id.*; *see also* Lindstad, Ex. 1013, 4:63-5:8; 2:6-35; 2:55-75; claims 4-5.) The weight controller and speed controller of Crake operate in the same manner. (Crake, Ex. 1015, 5:66-6:26; Pinckard

	Decl., Ex. 1012, ¶ 44.) The release of the drill string of Crake has a "direct effect" at the drill bit because the drill bit is attached to the bottom of the drill string and moves with the drill string. (Crake, Ex. 1015, Fig. 1; Pinckard Decl., Ex. 1012, ¶ 43.)
[11a] 11. A method for automatically regulating the release of the drill string of a drilling rig drill having a drill bit in association therewith, comprising the steps of:	Lindstad discloses the elements of the preamble for the reasons explained in Ground 1. In addition, Crake discloses the elements of the preamble for the reasons explained in [1a] above.
[11b] measuring drilling fluid pressure;	Lindstad discloses the limitations of this step for the reasons explained in Ground 1.
[11c] producing a signal in response to changes in drilling fluid pressure, said signal representing the changes in drilling fluid pressure;	Lindstad discloses the limitations of this step for the reasons explained in Ground 1.
[11d] relaying said signal to a drill string controller; and	Lindstad discloses the limitations of this step for the reasons explained in Ground 1.
[11e] controlling said drill string controller to increase the rate of release of said drill string with direct effect at the drill bit associated with the drill string when said signal represents a decrease in drilling fluid pressure and to decrease the rate of release of said drill string with direct effect at the drill bit associated with the drill string when said signal represents an increase in	See element [1e] above.

drilling fluid pressure.	
[14a] 14. A method for automatically regulating the release of the drill string of a drilling rig drill, comprising the steps of:	Lindstad discloses the elements of the preamble for the reasons explained in Ground 1. In addition, Crake discloses the elements of the preamble for the reasons explained in [1a] above.
[14b] measuring drilling fluid pressure and bit weight;	Linstad and Stoner disclose the limitations of this step for the reasons explained in Ground 1. In addition, Crake discloses the step of measuring bit weight. (Crake, Ex. 1015, 3:36-51; Fig. 2; Pinckard Decl., Ex. 1012, ¶ 41.)
[14c] producing a first signal in response to changes in drilling fluid pressure, said first signal representing the changes in drilling fluid pressure;	Linstad discloses the limitations of this step for the reasons explained in Ground 1.
[14d] producing a second signal in response to changes in bit weight, said second signal representing the changes in bit weight;	Stoner (which is incorporated into Lindstad by reference) discloses the limitations of this step for the reasons explained in Ground 1. In addition, Crake discloses the limitations of this step. A change in bit weight "results in a contraction of the Bourdon tube of the weight controller, which permits the pressure fluid to escape through channel 55, thereby relieving the pressure on the diaphragm 21 of fluid motor 28, and applying the brake 19 to slow down the bit feed rate . . . ." (Crake, Ex. 1015, 5:74-6:9; Pinckard Decl., Ex. 1012, ¶ 41.)
[14e] selecting any one of said first signal, said second signal, and both said first and said second signals to control the release of said drill string; and	Lindstad and Stoner disclose the limitations of this step for the reasons explained in Ground 1. In addition, Crake discloses "selecting" a signal representing changes in bit weight, a signal representing changes in rate of penetration, or both signals. (Crake, Ex. 1015, 5:66-6:26; Pinckard Decl., Ex. 1012, ¶ 45.) It would have been obvious to one of ordinary skill in the art at the time of the '142 invention to include a drilling fluid pressure controller to the control system of Crake based on the teachings of Lindstad. (Pinckard Decl., Ex.

	1012, ¶ 45.) Upon addition of a drilling fluid pressure controller to the drill control system of Crake, the system would "select" the signal generated by the weight controller, the drilling fluid pressure controller, or both in the same manner that Crake already discloses "selecting" between the signals generated by the weight controller and the speed controller. (*Id.*; *see also* Crake, Ex. 1015, 5:66-6:26.)
[14f] relaying said selected signal or signals to a drill string controller which regulates the release said drill string in response to said selected signal or signals.	Lindstad and Stoner disclose the limitations of this step for the reasons explained in Ground 1. In the event the Board adopts a narrow construction of the term "release" to exclude a drill with a motor that exerts a downward force on the drill string as in Lindstad, claim 14 would nonetheless be obvious over Lindstad and Crake (see [1e] above). Crake discloses that when the bit weight exceeds the set point, the weight controller causes the fluid motor 28 to apply the brake 19 to reduce the rate of release of the drill string: "Upon the drill bit encountering thereafter a hard layer where the penetration rate is for example only 4 feet per hour, the fee rate is in excess of the penetration rate, resulting immediately in a slack in the cable and a corresponding increase of the weight on the bit to a value in excess of 10,000 lbs., thus causing an undesirable condition. The slack on the cable, however, results in a contraction of the Bourdon tube of the weight controller, which permits the pressure fluid to escape through channel 55, thereby relieving the pressure on the diaphragm 27 of fluid motor 28, and applying the brake 19 to slow down the bit feed rate." (Crake, Ex. 1015, 5:66-6:9; Pinckard Decl., Ex. 1012, ¶ 41-42.) A decrease in bit weight causes the reverse to happen: "If, after passing through the hard layer, the bit encounters an extremely soft formation, or even a cavity in the ground, all weight is momentarily removed from the bit and is carried in the cable. The weight controller acts in this case to disengage the brake 19, and the drum 8, under the effect of the heavy weight of the drill string, has a tendency to unwind at a very high rate, thus dropping

	the drill string to the bottom." (Crake, Ex. 1015, 6:10-18; Pinckard Decl., Ex. 1012, ¶ 42.)

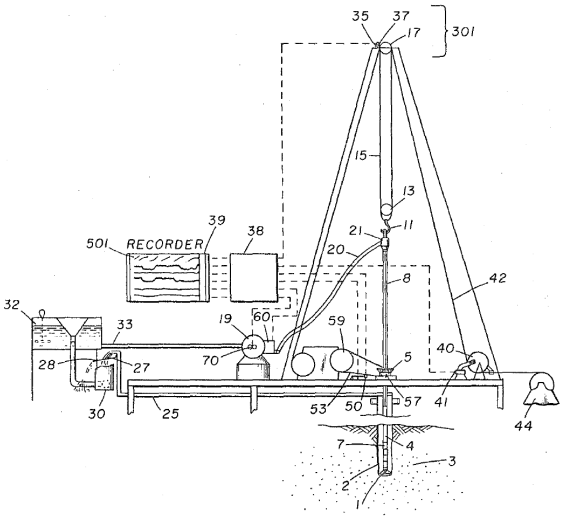
Ground 3: Claims 1, 11, and 14 are invalid under 35 U.S.C. § 103(a) over Lindstad and Brooks.

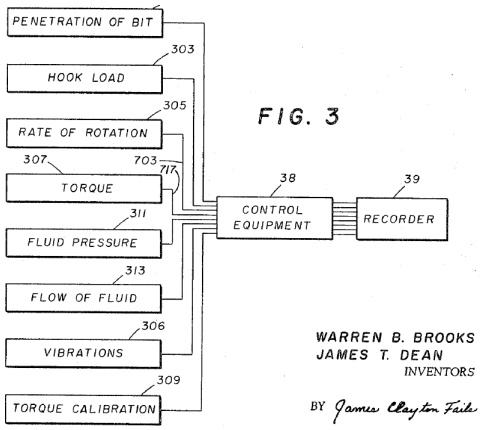
If Lindstad does not anticipate claims 1, 11, and 14, then Lindstad renders these claims obvious under § 103(a) in combination with United States Patent No. 3,324,717 to Brooks ("Brooks") (Ex. 1017). Brooks issued on June 13, 1967.

As discussed above in conjunction with Ground 2, the Patent Owner may argue for a narrow construction of the term "release" and that Lindstad fails to disclose the "release" of the drill string because Lindstad uses a motor to exert a downward force on the drill string. If the Board adopts such a narrow construction of the term "release," claims 1, 11, and 14 are nonetheless invalid under § 103(a) over Lindstad and Brooks.

Lindstad: Lindstad is explained above in conjunction with Ground 1.

Brooks: Brooks discloses a drilling rig with a drilling information gathering system for detecting various drilling parameters, including weight on bit and drilling fluid pressure. (Brooks, Ex. 1017, 3:23-41.) In addition, Brooks discloses that the release of the drill string can be automatically regulated in response to changes in bit weight. (*Id.* 9:68-10:6.)





A combination of Lindstad and Brooks would result in an oilwell drilling system that measures both bit weight and drilling fluid pressure, and automatically regulates the release of the drill string based on changes in these parameters.

Motivation to Combine: A person of ordinary skill in the art at the time of the '142 patent invention would have been motivated to combine the teachings of Lindstad and Brooks for the same reason discussed above in Ground 2 (i.e., because the automatic bit weight driller disclosed in Brooks would not operate properly for directional and horizontal drilling). (Pinckard Decl., Ex. 1012, ¶ 49.)

In addition, Brooks teaches the importance of measure at least six drilling parameters, including both bit weight and drilling fluid pressure: "To get a complete picture of the efficiency of a drilling operation, it is necessary to know the value of at least six variables: (1) drilling rate or penetration with respect to time; (2) weight on the bit; (3) rate of rotation of the drill string; (4) torque imparted to the drill string, often referred to simply as torque; (5) pressure of the

drilling fluid; and (6) flow, or circulation rate, of the drilling fluid." (Pinckard Decl., Ex. 1012, ¶ 50; Brooks, Ex. 1017, 1:49-56.) Brooks teaches the benefit of monitoring various drilling parameters as drilling operations become more automated: "Further inquiry into the complex and interrelated variables of the drilling operation reinforces the conclusion that only a drilling information gathering system will suffice. This becomes especially true in the forthcoming automation of the drilling operation." (Pinckard Decl., Ex. 1012, ¶ 50; Brooks, Ex. 1017, 3:49-53.) Brooks also teaches the importance of monitoring drilling fluid pressure to both optimize the drilling rate and avoid adverse events. (Pinckard Decl., Ex. 1012, ¶ 50; Brooks, Ex. 1017, 5:40-75.) Accordingly, one of ordinary skill in the art would have been motivated to combine the teachings of Brooks with a prior art system that teaches the automatic regulation of the drill string based on changes in drilling fluid pressure (such as Lindstad). (Pinckard Decl., Ex. 1012, ¶ 50.)

[1a] 1. An automatic drilling system for automatically regulating the release of the drill string of a drilling rig having a drill bit in association therewith during the drilling of a borehole, comprising:	Lindstad discloses the elements of the preamble for the reasons explained above in Ground 1. In addition, Brooks discloses drilling system that automatically regulates the release of the drill string of a drilling rig based on changes in bit weight. (Brooks, Ex. 1017, 9:71-10:6; Pinckard Decl., Ex. 1012, ¶ 47.) The drilling rig disclosed in Brooks has a drill bit in association therewith. (Brooks, Ex. 1017, 6:50-52; Pinckard Decl., Ex. 1012, ¶ 51.)
[1b] a drilling fluid pressure sensor;	Lindstad discloses this element for the reasons explained above in Ground 1. Brooks also discloses a drilling

	fluid pressure sensor: "[T]he pressure on the drilling fluid being circulated is monitored on the discharge manifold 60 of the fluid pump 19. A standard BLH pressure cell which is available from Waltham, Massachusetts is used for this purpose." (Brooks, Ex. 1017, 11:65-70; Pinckard Decl., Ex. 1012, ¶ 52.)
[1c] a drilling fluid pressure regulator coupled to said drilling fluid pressure sensor, said drilling fluid pressure regulator measuring changes in drilling fluid pressure and outputting a signal representing those changes;	Lindstad discloses these limitations for the reasons explained above in Ground 1. Brooks also discloses outputting a signal representing changes in drilling fluid pressure: "The means for generating a function output representing fluid pressure, designated by a block 311, is connected, as shown in the block diagram of FIGURE 3, through the control equipment 38 to the recorder 39. . . ." (Brooks, Ex. 1017, 11:64-12:19; Pinckard Decl., Ex. 1012, ¶ 53.) The signal is in the form of voltage such that the amount of change is indicated by the amount of voltage. (*Id.*; *see also* Brooks, Ex. 1017, Fig. 4.)
[1d] a relay coupled to said drilling fluid pressure regulator, said relay responsive to the output signal of said drilling fluid pressure regulator to supply a drill string control signal at an output thereof; and	Lindstad discloses all of these limitations for the reasons explained above in Ground 1.
[1e] a drill string controller coupled to said relay wherein a decrease in drilling fluid pressure results in said relay supplying a drill string control signal that operates said drill string controller to effect an increase in the rate of release of said drill string with direct effect	Lindstad discloses all of these limitations for the reasons explained above in Ground 1. In the event the Board adopts a narrow construction of the term "release" to exclude a drill with a motor that exerts a downward force on the drill string as in Lindstad, claim 1 would nonetheless be obvious over Lindstad and Brooks. (Pinckard Decl., Ex. 1012, ¶ 58.) Brooks discloses a drill for oilwell drilling. (*Id.*; Brooks, Ex. 1017, 1:21-22.) There is no motor that exerts a downward force on the drill string. (*See generally id.*; 6:50-58; Pinckard Decl., Ex. 1012, ¶ 58.) Instead, the only force applied to the drill string is the weight of the drill string itself,

at the drill bit associated with the drill string and an increase in drilling fluid pressure results in said relay supplying a drill string control signal that operates said drill string controller to effect a decrease in the rate of release of said drill string with direct effect at the drill bit associated with the drill string.	similar to the '142 patent. (Brooks, Ex. 1017, 6:50-58; Pinckard Decl., Ex. 1012, ¶ 58.) Brooks discloses a drill that automatically regulates the release of the drill string in response to changes in bit weight. (Brooks, Ex. 1017, 9:69-10:6; Pinckard Decl., Ex. 1012, ¶ 58.) Brooks also discloses the step of measuring drilling fluid pressure. (Brooks, Ex. 1017, 11:65-70; Pinckard Decl., Ex. 1012, ¶ 58.) It would have been obvious to one of ordinary skill in the art at the time of the '142 invention to use the drilling fluid measurements taught by Brooks to control the release of the drill string based on the teachings of Lindstad. (Pinckard Decl., Ex. 1012, ¶ 58.) The system of Brooks would regulate the release of the drill string in response to changes in drilling fluid pressure in the same manner in which it already regulates the release of the drill string in response to changes in bit weight. (*Id.*; Brooks, Ex. 1017, 9:69-10:6.) The release of the drill string of Brooks has a "direct effect" at the drill bit because the drill bit is attached to the bottom of the drill string and moves with the drill string. (Brooks, Ex. 1017, Fig. 1; Pinckard Decl., Ex. 1012, ¶ 57.)
[11a] 11. A method for automatically regulating the release of the drill string of a drilling rig drill having a drill bit in association therewith, comprising the steps of:	Lindstad discloses the elements of the preamble for the reasons explained in Ground 1. Brooks also discloses the elements of the preamble for the reasons explained in [1a] above.
[11b] measuring drilling fluid pressure;	Lindstad discloses the limitations of this step for the reasons explained in Ground 1. Brooks also discloses the limitations of this step for the reasons explained in [1b] above.
[11c] producing a signal in response to changes in drilling fluid pressure, said signal representing the changes in drilling fluid pressure;	Lindstad discloses the limitations of this step for the reasons explained in Ground 1. Brooks also discloses the limitations of this step for the reasons explained in [1c] above.

[11d] relaying said signal to a drill string controller; and	Lindstad discloses the limitations of this step for the reasons explained in Ground 1.
[11e] controlling said drill string controller to increase the rate of release of said drill string with direct effect at the drill bit associated with the drill string when said signal represents a decrease in drilling fluid pressure and to decrease the rate of release of said drill string with direct effect at the drill bit associated with the drill string when said signal represents an increase in drilling fluid pressure.	See element [1e] above.
[14a] 14. A method for automatically regulating the release of the drill string of a drilling rig drill, comprising the steps of:	Lindstad discloses the elements of the preamble for the reasons explained in Ground 1. Brooks also discloses the elements of the preamble for the reasons explained in [1a] above.
[14b] measuring drilling fluid pressure and bit weight;	Linstad and Stoner disclose the limitations of this step for the reasons explained in Ground 1. Brooks also discloses measuring drilling fluid pressure for the reasons explained in [1b] above. Brooks discloses measuring bit weight using a pressure transducer attached to the deadline diaphragm unit for the cable that controls the drill stem: "As a means for generating a second function representative of hook load, or modified to represent weight on the bit, we use the following instrumentation. To measure the weight on the bit, we connect a deadline diaphragm unit 40 (FIGURE 1) a strain gauge type pressure transducer 41."

	(Brooks, Ex. 1017, 8:30-35; Fig. 1; Pinckard Decl., Ex. 1012, ¶ 54.) In an alternative embodiment, Brooks teaches that the hook load (which can be modified to represent bit weight) can be measured using strain gauges on the bail of a swivel of the draw works: "An alternative embodiment can be seen in FIGURE 6. . . . That is, strain gauges 601 and temperature compensating strain gauges 603 are installed on the bail 605 of a swivel 21. . . . This method affords an excellent, stable, sensitive way to monitor indirectly the weight on the bit by monitoring the hook load. As taught above, control equipment 38 can be manipulated to generate a function representative of weight on the bit." (Brooks, Ex. 1017, 9:31-50; Pinckard Decl., Ex. 1012, ¶ 54.)
[14c] producing a first signal in response to changes in drilling fluid pressure, said first signal representing the changes in drilling fluid pressure;	Linstad discloses the limitations of this step for the reasons explained in Ground 1. Brooks also discloses the limitations of this step for the reasons explained in [1c] above.
[14d] producing a second signal in response to changes in bit weight, said second signal representing the changes in bit weight;	Stoner (which Lindstad incorporates by reference) discloses the limitations of this step for the reasons explained in Ground 1. In addition, Brooks discloses that the bit weight measurements are recorded over time to monitor changes: "The output from either of these instruments [the pressure transducer or strain gauges], measuring the hook load, goes to the control equipment 38, where it is corrected to measure weight on the bit. This is then sent to recorder 39 where it is recorded on the record which is being advanced with advancing time." (Brooks, Ex. 1017, 9:69-73; Pinckard Decl., Ex. 1012, ¶ 55.) Brooks discloses that the changes in bit weight can be used as a control signal to automatically control the release of the drill string: "Thus, the value of the weight on the bit which produced the particular penetration, plotted on the same advancing record as the penetration, can be observed and used in subsequent

	comparative tests. It can thus be used to control, manually or automatically, the lowering of the travelling block to achieve and maintain any desired weight on the bit." (Brooks, Ex. 1017, 9:75-10:6; Pinckard Decl., Ex. 1012, ¶ 56.) The signal is in the form of voltage such that the amount of change is indicated by the amount of voltage. (Brooks, Ex. 1017, 8:50-75; 9:42-44; Pinckard Decl., Ex. 1012, ¶ 56.)
[14e] selecting any one of said first signal, said second signal, and both said first and said second signals to control the release of said drill string; and	Lindstad and Stoner disclose the limitations of this step for the reasons explained in Ground 1. In addition, It would have been obvious to one of ordinary skill in the art at the time of the '142 invention to use the system disclosed in Brooks to automatically regulate the release of the drill string in response to changes in drilling fluid pressure based on the teachings of Lindstad. (Pinckard Decl., Ex. 1012, ¶ 58.) By adding this feature to Brooks, the system disclosed in Brooks would "select" the drilling fluid pressure signal, the bit weight signal, or both to control the release of the drill string. (*Id.* ¶ 59.)
[14f] relaying said selected signal or signals to a drill string controller which regulates the release said drill string in response to said selected signal or signals.	Lindstad and Stoner disclose the limitations of this step for the reasons explained in Ground 1. In the event the Board adopts a narrow construction of the term "release" to exclude a drill with a motor that exerts a downward force on the drill string as in Lindstad, claim 14 would nonetheless be obvious over Lindstad and Brooks (see [1e] above). The system of Brooks would regulate the release of the drill string in response to changes in drilling fluid pressure in the same manner in which it already regulates the release of the drill string in response to changes in bit weight. (Brooks, Ex. 1017, 9:69-10:6; Pinckard Decl., Ex. 1012, ¶ 56.)

Ground 4: Claims 1, 11, and 14 are invalid under 35 U.S.C. § 102(b) over Warren.

Claims 1, 11 and 14 are invalid under 35 U.S.C. § 102(b) by U.S. Patent No. 4,854,397 to Warren ("Warren") (Ex. 1018). Warren issued on August 8, 1989.

Although Warren is listed as one of the "References Cited" on the reexamination certificate for the '142 patent that issued on July 13, 2010, there is no indication that the Examiner considered Warren as an invalidating reference. The reexamination petitioner submitted Warren for "historical context," but not as a basis for a substantial new question of patentability. (Request for *Ex Parte* Reexamination, Ex. 1019, p. 5.) The Examiner did not mention Warren in any of his office actions. (*See generally* Exs. 1020-1021 & Ex. 1007.) Accordingly, there is no indication that the Patent Office previously considered Warren as an invalidating reference.

Warren discloses a system for directional drilling. (*See generally* Warren, Ex. 1018.) In conjunction with that system, Warren discloses a system that automatically regulates the release of the drill string in response to changes in various drilling parameters, including fluid pressure and weight on bit. (*Id.* 3:1-16; 4:13-38.)

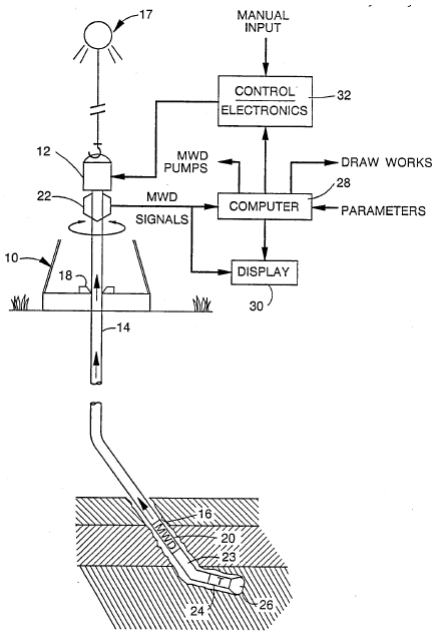


FIG. 1

Warren discloses that various drilling parameters, including fluid pressure and weight on bit, can be measured by a measurement-while-drilling (MWD) tool 20, which measurements can then be used to control the drilling operations, including the release of the drill string. (*Id.*

3:1-16; 4:13-38.)

The drilling parameter measurements are transmitted from the MWD tool to the surface where they are received by a data receiving device 22. (*Id.* 3:41-49; Figs. 1-2.) The signals are stored in the memory of a programmable digital computer 28. (*Id.* 3:57-60; Figs. 1-2.) Prior to drilling, the desired limits of the drilling parameters are inputted into the memory of the computer. (*Id.* 4:13-16.) During drilling, computer logic within the computer compares the downhole values with the desired limits. (*Id.* 4:25-29.) If any of the values is outside the desired limits, the computer logic causes an alarm to be activated so corrective action can be taken. (*Id.* 4:29-32.) Warren discloses that preferably, one corrective action is to regulate the draw works 17 and that "[m]ost preferably, the logic calculates the optimum adjustment necessary to the devices so that the parameter values are brought back to within the desired limits." (*Id.* 4:32-38; Figs. 1-2.) The computer is operatively connected to the controls of the draw works 17 to achieve this adjustment. (*Id.* 4:3-5; Figs. 1-2.)

Claims 1, 11 and 14 of the '142 patent are mapped to the disclosures of Warren in the following claim chart.

[1a] 1. An automatic drilling system for automatically regulating the release of the drill string of a drilling rig	Warren discloses a drilling system that automatically regulates the release of the drill string in response to changes in various drilling parameters measured by a measurement-while-drilling tool. (Warren, Ex. 1018, 3:1-38; Pinckard Decl., Ex. 1012, ¶ 61.) The drilling

having a drill bit in association therewith during the drilling of a borehole, comprising:	rig disclosed in Warren has a drill bit 26 in association therewith. (Warren, Ex. 1018, 3:52-56; Fig. 1; Pinckard Decl., Ex. 1012, ¶ 61.)
[1b] a drilling fluid pressure sensor;	Warren discloses a drilling fluid pressure sensor in the form of a measurement-while-drilling (MWD) tool: "The downhole data collection and transmission device can be any commercially available downhole measurement-while drilling (MWD) tool that transmits data to the surface either by mud pulse or electromagnetic energy." (Warren, Ex. 1018, 3:1-5 Pinckard Decl., Ex. 1012, ¶ 62.) The MWD tool measures various drilling parameters, including downhole pressure (which is "drilling fluid pressure"): "Regardless of what type of device is used, at a minimum the device needs to transmit an accurate measurement of wellbore inclination, azimuthal direction (from True North, for example) and drillstring orientation. Any other transmitted data, referred to as drilling associated parameters, such as drill bit torque, RPM, WOB, downhole temperature, downhole pressure and the like, can be used if available." (Warren, Ex. 1018, 3:9-16; Pinckard Decl., Ex. 1012, ¶ 62.) The MWD tool is connected to a lower end of the drillstring: "A downhole telemetry measurement and transmission device 20, commonly referred to as a measurement-while-drilling (MWD) tool is connected to a lower end of the drillstring 14 and transmits drilling associated parameters to the surface by mud pulse or electromagnetic transmission." (Warren, Ex. 1018, 3:41-46; Pinckard Decl., Ex. 1012, ¶ 62.)
[1c] a drilling fluid pressure regulator coupled to said drilling fluid pressure sensor, said drilling fluid pressure regulator measuring changes in drilling fluid pressure	Warren discloses a "drilling fluid pressure regulator" in the form of a data reception device connected to a computer. Warren discloses that the MWD tool sends signals regarding the drilling parameters to a data reception device: "The [drilling associated parameter] signals are received at the surface by a data receiving device 22, which is commercially available and necessary with use of an MWD tool." (Warren, Ex.

and outputting a signal representing those changes;	1018, 3:41-49; Pinckard Decl., Ex. 1012, ¶ 63.) The data reception device stores the signals in the memory of a programmable digital computer: "The downhole signals received by the data reception device 22 are provided by direct electrical or indirect cable, fiberoptic or radio link to a memory associated with a programmable digital computer 28." (Warren, Ex. 1018, 3:57-60; Fig. 1; Pinckard Decl., Ex. 1012, ¶ 64.) The computer compares the signals received from the MWD to the desired limits for the parameters previously stored in the memory of the computer: "[D]esired limits of the drilling associated parameters to be monitored are inputted into the memory associated with the programmable digital computer 28. . . . Drilling is commenced and the MWD signals are sent to the computer 28 and display device 30. Computer logic within the programmable digital computer compares and correlates the desired limits for the drilling associated parameters." (Warren, Ex. 1018, 4:13-29; Pinckard Decl., Ex. 1012, ¶ 65.) The computer is operatively connected to the controls for draw works of the drill string: "The programmable digital computer 28 is operatively connected to controls of the draw works 17 to control WOB, ..." (Warren, Ex. 1018, 4:3-5; Figs. 1-2; Pinckard Decl., Ex. 1012, ¶ 66.) The computer sends signals to the controls of the draw works representing undesirable changes in the parameters: "If any one of the [drilling parameter] values is outside the desired limits then the programmable digital computer's logic causes an alarm to be activated so corrective action can be taken. Preferably, the logic causes the draw works 17, top drive or power swivel 12, rotary table 18 and/or mud pumps to be adjusted by a preselected amount or increment. Most preferably, the logic calculates the optimum adjustments necessary to the devices so that the parameter values are brought back to within the desired limits." (Warren, Ex. 1018, 4:29-38; Fig. 2; Pinckard Decl., Ex. 1012, ¶ 67.)

[1d] a relay coupled to said drilling fluid pressure regulator, said relay responsive to the output signal of said drilling fluid pressure regulator to supply a drill string control signal at an output thereof; and	Warren discloses that the computer is operatively connected to the controls for draw works of the drill string: "The programmable digital computer 28 is operatively connected to controls of the draw works 17 to control WOB, ..." (Warren, Ex. 1018, 4:3-5; Figs. 1-2; Pinckard Decl., Ex. 1012, ¶ 66.) The "relay" (the connection between the computer and the controls of the draw works) supplies a "drill string control signal" at its output, which causes the draw works to regulate the release of the drill string: "If any one of the [drilling parameter] values is outside the desired limits then the programmable digital computer's logic causes an alarm to be activated so corrective action can be taken. Preferably, the logic causes the draw works 17, top drive or power swivel 12, rotary table 18 and/or mud pumps to be adjusted by a preselected amount or increment. Most preferably, the logic calculates the optimum adjustments necessary to the devices so that the parameter values are brought back to within the desired limits." (Warren, Ex. 1018, 4:29-38; Fig. 2; Pinckard Decl., Ex. 1012, ¶ 67.)
[1e] a drill string controller coupled to said relay wherein a decrease in drilling fluid pressure results in said relay supplying a drill string control signal that operates said drill string controller to effect an increase in the rate of release of said drill string with direct effect at the drill bit associated with the drill string and an increase in drilling fluid pressure results in said relay supplying a drill string control signal that	Warren discloses that the controls of the draw works are operatively connected to the computer. (Warren, Ex. 1018, 4:3-5; Figs. 1-2; Pinckard Decl., Ex. 1012, ¶ 66.) The computer causes the draw works to be regulated in response to changes in the parameters measured by the MWD tool. (Warren, Ex. 1018, 4:3-38; Pinckard Decl., Ex. 1012, ¶ 67.) With respect to fluid pressure, Warren necessarily teaches that an increase in the fluid pressure above the preselected limit would cause the draw works to decrease the rate of release of the drill string and vice versa. (Pinckard Decl., Ex. 1012, ¶ 67.) This causes a "direct effect" at the drill bit because the drill bit is attached to the bottom of the drill string and moves with the drill string. (*Id.* ¶ 68; Warren, Ex. 1018, Fig. 1.)

operates said drill string controller to effect a decrease in the rate of release of said drill string with direct effect at the drill bit associated with the drill string.	
[11a] 11. A method for automatically regulating the release of the drill string of a drilling rig drill having a drill bit in association therewith, comprising the steps of:	Warren discloses the elements of the preamble for the reasons explained in [1a] above.
[11b] measuring drilling fluid pressure;	Warren discloses the limitations of this step for the reasons explained in [1b] above.
[11c] producing a signal in response to changes in drilling fluid pressure, said signal representing the changes in drilling fluid pressure;	Warren discloses the limitations of this step for the reasons explained in [1c] above.
[1d] relaying said signal to a drill string controller; and	Warren discloses the limitations of this step for the reasons explained in [1d] above.
controlling said drill `string controller to increase the rate of release of said drill string with direct effect at the drill bit associated with the drill string when said signal represents a decrease in drilling fluid pressure and to decrease the rate of release of said drill string with direct effect at the drill bit associated with the drill	Warren discloses the limitations of this step for the reasons explained in [1e] above.

string when said signal represents an increase in drilling fluid pressure.	
[14a] 14. A method for automatically regulating the release of the drill string of a drilling rig drill, comprising the steps of:	Warren discloses the elements of the preamble for the reasons explained in [1a] above.
[14b] measuring drilling fluid pressure and bit weight;	Warren discloses the step of measuring drilling fluid for the reasons explained in [1b] above. The same passage cited in [1b] above also discloses measuring bit weight. (Warren, Ex. 1018, 3:9-16; Pinckard Decl., Ex. 1012, ¶ 62.)
[14c] producing a first signal in response to changes in drilling fluid pressure, said first signal representing the changes in drilling fluid pressure;	Warren discloses the limitations of this step for the reasons discussed in [1c] above.
[14d] producing a second signal in response to changes in bit weight, said second signal representing the changes in bit weight;	As with fluid pressure, Warren discloses that a computer produces a signal in response to changes in bit weight, the signal representing changes in bit weight (see the above discussion for [1c]).
[14e] selecting any one of said first signal, said second signal, and both said first and said second signals to control the release of said drill string; and	Warren discloses that one or more of the signals representing changes in the drilling parameters (including drilling fluid pressure and bit weight) is selected to control the draw works based on the desired limits of the drilling parameters that are inputted into the computer prior to drilling: "[D]esired limits of the drilling associated parameters to be monitored are inputted into the memory associated with the programmable digital computer 28. . . . Drilling is commenced and the MWD signals are sent to the computer 28 and display device 30. Computer logic within the programmable digital computer compares and correlates the desired limits for the drilling

	associated parameters." (Warren, Ex. 1018, 4:13-29; Pinckard Decl., Ex. 1012, ¶ 65.) If any one of the parameters is outside the desired limits, corrective action can be taken, including adjusting the draw works. (Warren, Ex. 1018, 4:29-38; Fig. 2; Pinckard Decl., Ex. 1012, ¶ 67.)
[14f] relaying said selected signal or signals to a drill string controller which regulates the release said drill string in response to said selected signal or signals.	Warren discloses that the computer sends signals to the controls of the draw works to regulate the release of the drill string. (Warren, Ex. 1018, 4:29-38; Fig. 2; Pinckard Decl., Ex. 1012, ¶ 67.)

Ground 5: Claims 1, 11, and 14 are invalid under 35 U.S.C. § 103(a) over Warren and Brooks.

If Warren does not anticipate claims 1, 11, and 14, then Warren renders these claims obvious under § 103(a) in combination with Brooks.

The Patent Owner may argue that Warren does not teach each and every element of the subject claims because Warren discloses the use of sensors (in the form of a MWD device) that are located downhole just above the drill bit. For example, the Patent Owner may argue that the drilling fluid sensor on the MWD device is not "coupled" (claim 1) to the drilling fluid pressure regulator at the surface (despite being coupled via the drill string). Similarly, the Patent Owner may argue that the mud and drill string (which send the drilling parameter signals via mud pulses or electromagnetic transmission) are not "relays" (claim 1). Although Petitioner contends that these arguments are without merit, if the Board

adopts such arguments, the subject claims would nonetheless be obvious over Warren in combination with Brooks. (Pinckard Decl., Ex. 1012, ¶ 70.)

Instead of using downhole sensors that are part of a MWD device as disclosed in Warren, it would have been obvious to one of ordinary skill in the art to employ conventional sensors at the surface as disclosed in Brooks. (*Id.* ¶ 71.) The details of those sensors are described above in conjunction with Ground 3. The use of surface sensors versus downhole sensors is a matter of mere preference and both were well known in the art at the time of the '142 patent. (*Id.*)

Claims 1, 11 and 14 of the '142 patent are mapped to the disclosures of Warren in claim charts provided in conjunction with Ground 4 above. Claims 1, 11 and 14 of the '142 patent are mapped to the disclosures of Brooks in the claim charts provided in conjunction with Ground 3 above.

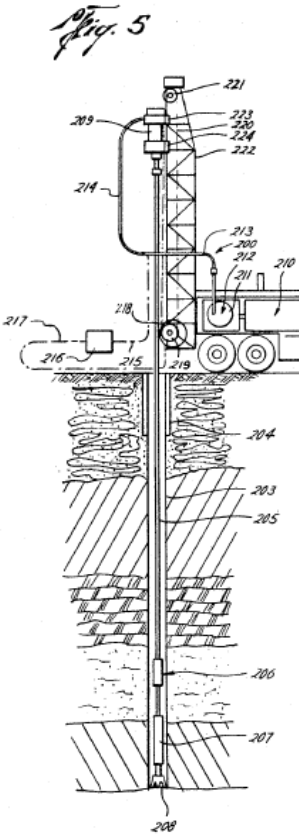
Ground 6: Claims 1 and 11 are invalid under 35 U.S.C. § 102(b) over Miller.

Ground 7: Claim 14 is invalid under 35 U.S.C. § 103(a) over Miller and Crake.

Claims 1 and 11 are invalid under 35 U.S.C. § 102(b) over U.S. Patent No. 3,463,252 to Miller ("Miller") (Ex. 1022). Miller issued on August 26, 1969. Claim 14 is invalid under 35 U.S.C. § 103(a) over Miller and Crake.

Miller: Miller teaches a drilling system that automatically regulates the release of the drill string in response to changes in drilling fluid pressure. (Miller,

Ex. 1022, 1:25-27.) Miller discloses a drilling rig with a drill string 205 and a drill bit 208. (*Id.* 6:40-55; Fig. 5.) The raising and lowering of the drill string is controlled by a motor 218. (*Id.* 7:15-35; Fig. 5.)



The lower end of the drill string of Miller includes a telescopic joint 206. (*Id.* 6:40-55.) The telescopic joint is used to automatically regulate the release of the drill string based on changes in drilling fluid pressure. (*Id.* 10:62-12:50.) The telescopic joint includes "a vent opened when the joint is near full extended to signal the surface by a drop in pressure and a choke that is actuated to raise the pressure when the joint is near full contraction." (*Id.* 10:62-75.) When the telescopic joint extends and the air pressure drops, this signals the motor 218 to lower the drill string. (*Id.* 12:14-29.) As the drill string lowers and the telescopic joint contracts, the vent closes causing the fluid pressure to rise, which deactivates the lowering of the drill string. (*Id.* 12:37-50.)

Crake: Crake is explained above in conjunction with Ground 2.

A combination of Crake and Miller would result in a drilling rig that measures both bit weight and drilling fluid pressure, and automatically regulates the release of the drill string based on changes in these parameters.

Motivation to Combine: A person of ordinary skill in the art at the time of the '142 patent invention would have been motivated to combine the teachings of Crake and Miller for the same reason discussed in Ground 2 (i.e., because the automatic bit weight driller disclosed in Crake would not operate properly for directional and horizontal drilling). (Pinckard Decl., Ex. 1012, ¶ 74.) A person of ordinary skill using the Crake system would have been motivated to add the features of the Miller system for use during directional and horizontal drilling to assess when the drill bit is "off bottom." (*Id.*) As indicated in the '142 patent, automatic bit weight drillers (as taught by Crake) do not operate properly for directional and horizontal drilling. ('142 patent, Ex. 1001, 1:36-50; Pinckard Decl., Ex. 1012, ¶ 70.) It would have been obvious to add the features of Miller to the Crake system to determine when the drill bit is "off bottom" during directional and horizontal drilling. (Pinckard Decl., Ex. 1012, ¶ 70.)

In addition, Miller discloses a motivation to combine its teachings with the teachings of Crake. Miller discloses the importance of maintaining proper weight on bit. (Pinckard Decl., Ex. 1012, ¶ 75; Miller, Ex. 1022, 2:20-23; 6:71-75.) Although Miller states that "*some* percussion bits usually work best with substantially zero or very little weight on bit" and that the disclosed telescoping joint can be used to ensure that no weight is imposed on the bit (Miller, Ex. 1022, 6:71-7:6 (emphasis added)), one of ordinary skill in the art would have been

motivated to combine the teachings of Miller with Crake in drilling operations where a greater amount of weight on bit is desired. (Pinckard Decl., Ex. 1012, ¶ 75.) One could use the telescopic joint of Miller to determine when the drill bit is "off bottom." (*Id.*) The system could be calibrated such that the brake would continue to allow the drill string to release until the desired bit weight is achieved (as measured by the bit weight sensor of Crake). (*Id.*)

Claims 1, 11 and 14 of the '142 patent are mapped to the disclosures of Miller and Crake in the following claim chart.

[1a] 1. An automatic drilling system for automatically regulating the release of the drill string of a drilling rig having a drill bit in association therewith during the drilling of a borehole, comprising:	Miller teaches a drilling system that automatically regulates the release of the drill string in response to changes in drilling fluid pressure. (Miller, Ex. 1022, 1:25-27; Pinckard Decl., Ex. 1012, ¶ 73.) The drilling rig disclosed in Miller has a drill bit 208 in association therewith. (Miller, Ex. 1022, 6:50-52; Fig. 5; Pinckard Decl., Ex. 1012, ¶ 76.)
[1b] a drilling fluid pressure sensor;	Miller teaches an automatic drilling system that can use air, gas, oil, or mud as the drilling fluid: "This invention relates to earth drilling and more particularly to apparatus for automatically lowering a drill string as the drill bit progresses down the earth bore. Although especially suited for use in drilling apparatus employing air or other gas as a medium to cool the bit and bring the cuttings to the surface, it may also be used in connection with other drilling apparatus, e.g. a system employing circulating mud to cool the bit and bring the cuttings to the surface." (Miller, Ex. 1022, 1:25-36, 13:65-68; Pinckard Decl., Ex. 1012, ¶ 78.) All of the embodiments use air as the drilling fluid. (*See generally* Miller, Ex. 1022; Pinckard Decl., Ex. 1012, ¶

	78.) Miller discloses a drilling fluid pressure sensor in the form of a spring loaded relief valve disposed between the air pipes carrying the drilling fluid. (Miller, Ex. 1022, 12:4-50; Figs. 15-16; Pinckard Decl., Ex. 1012, ¶ 79.)
[1c] a drilling fluid pressure regulator coupled to said drilling fluid pressure sensor, said drilling fluid pressure regulator measuring changes in drilling fluid pressure and outputting a signal representing those changes;	Miller discloses a drilling fluid pressure regulator in the form of surfaces control means in Figures 15-16 that sense changes in drilling fluid pressure and output a signal representing those changes. (Miller, Ex. 1022, 12:4-50; Figs. 15-16; Pinckard Decl., Ex. 1012, ¶ 80.)
[1d] a relay coupled to said drilling fluid pressure regulator, said relay responsive to the output signal of said drilling fluid pressure regulator to supply a drill string control signal at an output thereof; and	Miller discloses a relay coupled to the drilling fluid pressure regulator. The relay is a series of pipes and valves as described above in [1c] and depicted in Figures 5 and 15-16. (Pinckard Decl., Ex. 1012, ¶ 81.) The relay responds to the output signal of the drilling fluid pressure regulator to supply a drill string control signal at an output thereof. (*Id.*; Miller, Ex. 1022, 12:4-50.)
[1e] a drill string controller coupled to said relay wherein a decrease in drilling fluid pressure results in said relay supplying a drill string control signal that operates said drill string controller to effect an increase in the rate of release of said drill string with direct effect at the drill bit associated with the drill string and an	Miller discloses a drill string controller in the form of top head drive motor that controls the release of the drill string: "As the motor 218 drives the cable 220, the rotary drive means 209 is moved up or down raising or lowering the drill string. There is thus provided a vertical positioning means for the drill string." (Miller, Ex. 1022, 7:33-36; Pinckard Decl., Ex. 1012, ¶ 82.) Miller discloses that in one embodiment, a decrease in drilling fluid pressure results in an increase in the rate of release of the drill string (with a direct effect at the associated bit): "When the pressure in pipe 450 drops, e.g., a few p.s.i., spring 451 overcomes the pressure acting on piston 452 and the latter moves to the left. As piston 452 moves to the left, piston rod 453 pushes

increase in drilling fluid pressure results in said relay supplying a drill string control signal that operates said drill string controller to effect a decrease in the rate of release of said drill string with direct effect at the drill bit associated with the drill string.	stem 454 of spool valve 455 to the left. This opens port 456 to atmosphere and communicative port 457 with the interior of the body 457' of the spool valve. As a result, fluid from the pipe 458 passes through spool valve 455 to the left side of piston 459 forcing piston rod 460 to the right. Rod 460 is connected to stem 461 (FIGURE 16) of gate valve 462, which is thereby opened. When valve 462 opens, air feeding from pipe 215 through pipe 463 is supplied to valve 464 which is similar to valve 340 shown in FIGURE 11. When valve 464 opens, air is fed through pipe 465 to top head drive motor 218 (FIGURE 5). This lowers the drill string." (Miller, Ex. 1022, 12:14-29; Fig. 15; Pinckard Decl., Ex. 1012, ¶ 83.) Conversely, an increase in drilling fluid pressure causes a decrease in the rate of release of the drill string: "When the drill string is lowered enough so that the telescopic joint approaches full contraction, the flow constriction means of the joint becomes active and causes a rise in pressure of the drilling fluid. When the line pressure thus rises, e.g., a few p.s.i., the pressure at the left piston 470, fed through pipe 470' overcomes compression spring 471 and moves piston rod 472 to the right. This moves spool valve stem 454 to the right, as shown, opening port 457 to atmosphere and communicating port 456 with line pressure. Piston 459 is thus caused to move to the left, carrying with it stem 461 of gate valve 467, thereby closing valve 462. When pilot valve 462 closes, valve 464 closes and deactivated the vertical positioning means." (Miller, Ex. 1022, 12:37-50; Pinckard Decl., Ex. 1012, ¶ 84.) These movements necessarily have a "direct effect" at the drill bit in certain situations. (Pinckard Decl., Ex. 1012, ¶ 85.) If the drill bit is completely "off bottom," both the drill string and the drill bit will lower until the drill bit comes into contact with the bottom of the borehole. (*Id.*) Conversely, once the telescoping joint is fully contracted and the lower of the drill string

	ceases, this will prevent further driving of the drill bit into the bottom of the borehole. (*Id.*) *Note: The Examiner presiding over the second reexamination of the '142 patent allowed claims 1 and 11 over a reference with a telescopic joint similar to Miller (Le Compte) based on the Patent Owner's amendment to the claims adding the limitation that the release of the drill string has a "direct effect at the drill bit." However, that reexamination was *ex parte*, and there is no indication that the Examiner considered this argument that regulation of the release of a drill string with a telescopic joint would nonetheless have a "direct effect at the drill bit" for the reasons explained above.
[11a] 11. A method for automatically regulating the release of the drill string of a drilling rig drill having a drill bit in association therewith, comprising the steps of:	Miller discloses the elements of the preamble for the reasons explained in [1a] above.
[11b] measuring drilling fluid pressure;	Miller discloses the limitations of this step for the reasons explained in [1b] above.
[11c] producing a signal in response to changes in drilling fluid pressure, said signal representing the changes in drilling fluid pressure;	Miller discloses the limitations of this step for the reasons explained in [1c] above.
[11d] relaying said signal to a drill string controller; and	Miller discloses the limitations of this step for the reasons explained in [1d] above.
[11e] controlling said drill string controller to increase the rate of release of said drill string with direct effect at the drill bit associated with the drill string when said signal represents a	Miller discloses the limitations of this step for the reasons explained in [1e] above.

decrease in drilling fluid pressure and to decrease the rate of release of said drill string with direct effect at the drill bit associated with the drill string when said signal represents an increase in drilling fluid pressure.	
[14a] 14. A method for automatically regulating the release of the drill string of a drilling rig drill, comprising the steps of:	Miller discloses the elements of the preamble for the reasons explained in [1a] above. In addition, Crake discloses a drilling system that automatically regulates the release of the drill string in response to changes in bit weight and the rate of penetration of the drill bit. (Crake, Ex. 1015, 1:1-6; Pinckard Decl., Ex. 1012, ¶ 39.)
[14b] measuring drilling fluid pressure and bit weight;	Miller teaches measuring drilling fluid pressuring for the reasons explained in [1b] above. Crake discloses measuring bit weight. (Crake, Ex. 1015, 3:36-51; Fig. 2; Pinckard Decl., Ex. 1012, ¶ 41.)
[14c] producing a first signal in response to changes in drilling fluid pressure, said first signal representing the changes in drilling fluid pressure;	Miller discloses the step of producing a signal in response to changes in drilling fluid pressure representing changes in the drilling fluid pressure for the reasons explained in [1c] above.
[14d] producing a second signal in response to changes in bit weight, said second signal representing the changes in bit weight;	Crake discloses the limitations of this step. A change in bit weight "results in a contraction of the Bourdon tube of the weight controller, which permits the pressure fluid to escape through channel 55, thereby relieving the pressure on the diaphragm 21 of fluid motor 28, and applying the brake 19 to slow down the bit feed rate . . . ." (Crake, Ex. 1015, 5:74-6:9; Pinckard Decl., Ex. 1012, ¶ 41.)
[14e] selecting any one of said first signal, said second signal, and both said first and said second signals to control the	Crake discloses "selecting" a signal representing changes in bit weight, a signal representing changes in rate of penetration, or both signals. (Crake, Ex. 1015, 5:66-6:26; Pinckard Decl., Ex. 1012, ¶ 86.) It would have been obvious to one of ordinary skill in the art at

release of said drill string; and	the time of the '142 invention to include a drilling fluid pressure controller to the control system of Crake based on the teachings of Miller. (Pinckard Decl., Ex. 1012, ¶ 86.) Upon addition of a drilling fluid pressure controller to the drill control system of Crake, the system would "select" between a signal generated by the weight controller, the drilling fluid pressure controller, or both in the same manner that Crake already discloses "selecting" between the signals generated by the weight controller and the speed controller. (*Id.*; Crake, Ex. 1015, 5:66-6:26.)
[14f] relaying said selected signal or signals to a drill string controller which regulates the release said drill string in response to said selected signal or signals.	Crake discloses a drill that automatically regulates the release of the drill string in response to changes in bit weight and rate of penetration. (Crake, Ex. 1015, 1:1-6; Pinckard Decl., Ex. 1012, ¶ 39.) It would have been obvious to one of ordinary skill in the art at the time of the '142 invention to include a drilling fluid pressure controller to the control system of Crake based on the teachings of Miller. (Pinckard Decl., Ex. 1012, ¶ 86.) Crake discloses that each of the controllers relays a signal to a drill string controller, which regulates the release of the drill string. (Crake, Ex. 1015, 5:66-6:26; Pinckard Decl., Ex. 1012, ¶ 87.) Thus, the combined system of Crake and Miller would do the same. (Pinckard Decl., Ex. 1012, ¶ 87.)

Ground 8: Claim 14 is invalid under 35 U.S.C. § 103(a) over Le Compte and Crake.

Claim 14 is invalid under 35 U.S.C. § 103(a) over United States Patent No. 1,891,329 to Le Compte ("Le Compte") (Ex. 1023) and Crake (Ex. 1015). Le Compte issued on December 20, 1932.

Le Compte was cited as giving rise to a Substantial New Question of Patentability with respect to claims 1 and 11 during the second reexamination of

the ’142 patent. (Ex. 1019.) However, Le Compte was not cited as a prior art reference with respect to claim 14. (*Id.*)

The Examiner rejected claims 1 and 11 as being anticipated under § 102(b) by Le Compte. (Exs. 1020-1021.) In order to overcome the Examiner’s rejection, the Patent Owner amended claims 1 and 11 to recite the additional limitation that the release of the drill string has a “direct effect” at the drill bit. (Ex. 1024.) Claim 14 lacks this language, leaving it vulnerable to attack by Le Compte in combination with a prior art reference that teaches automatic regulation of the release of the drill string in response to changes in bit weight. As acknowledged in the specification of the ’142 patent, regulation based on bit weight was well known. (’142 patent, Ex. 1001, 1:14-35.)

Le Compte discloses a drilling system that automatically regulates the release of the drill string in response to changes in drilling fluid pressure. (Le Compte, Ex. 1023, 1:19-63.) Specifically, Le Compte discloses the use of a telescopic drill stem section that causes a buildup of fluid pressure (mud) as the telescopic section contracts, which causes the release of the drill string to automatically slow down. (*Id.*) As the telescopic section expands, the fluid pressure decreases, causing the release of the drill string to increase. (*Id.* 6:16-30.)

A combination of Crake and Le Compte would result in a drilling rig that measures both bit weight and drilling fluid pressure, and automatically regulates

the release of the drill string based on changes in these parameters.

Motivation to Combine: A person of ordinary skill in the art at the time of the '142 patent invention would have been motivated to combine the teachings of Crake and Le Compte for the same reason discussed in Ground 2 (i.e., because the automatic bit weight driller disclosed in Crake would not operate properly for directional and horizontal drilling). (Pinckard Decl., Ex. 1012, ¶ 90.) A person of ordinary skill using the Crake system would have been motivated to add the features of the Le Compte system for use during directional and horizontal drilling to assess when the drill bit is "off bottom." (*Id.*) As indicated in the '142 patent, automatic bit weight drillers (as taught by Crake) do not operate properly for directional and horizontal drilling. (*Id.*; '142 patent, Ex. 1001, 1:36-50.) It would have been obvious to add the features of Le Compte to the Crake system to determine when the drill bit is "off bottom" during directional and horizontal drilling. (Pinckard Decl., Ex. 1012, ¶ 90.)

A person of ordinary skill would have been motivated to use both bit weight (as in Crake) and drilling fluid pressure (as in Le Compte) to regulate the release of the drill string because the Le Compte system does not allow the driller to change the desired amount of bit weight during the drilling process. (Pinckard Decl., Ex. 1012, ¶ 91.) In the Le Compte system, the only weight applied to the drill bit is the weight of the lower drill string (the portion below the telescopic joint). (*Id.*; Le

Compte, Ex. 1023, 2:92-95.) As Le Compte teaches, this is desirable in deep well drilling and while drilling hard earth formations, such as granite. (Pinckard Decl., Ex. 1012, ¶ 91; Le Compte, Ex. 1023, 1:3-18.) However, it would be desirable to apply a greater weight on bit during the initial drilling process (before the drill progresses too deeply) and while drilling soft earth formations. (Pinckard Decl., Ex. 1012, ¶ 91.) Therefore, a person of ordinary skill using the Le Compte system would have been motivated to also measure changes in bit weight to regulate the release of the drill string (as taught by Crake) to provide flexibility in the amount of weight applied to the drill bit. (*Id.*) A driller using the Le Compte system (without the features of Crake) would have to drill the entire borehole using the same amount of weight on bit (the weight of the lower drill string). (*Id.*)

Claim 14 of the '142 patent is mapped to the disclosures of Le Compte and Crake in the following claim chart.

[14a] 14. A method for automatically regulating the release of the drill string of a drilling rig drill, comprising the steps of:	Le Compte discloses a drilling system that automatically regulates the release of the drill string in response to changes in drilling fluid pressure. (Le Compte, Ex. 1023, 1:19-63; Pinckard Decl., Ex. 1012, ¶ 89.) In addition, Crake discloses a drilling system that automatically regulates the release of the drill string in response to changes in bit weight and the rate of penetration of the drill bit. (Crake, Ex. 1015, 1:1-6; Pinckard Decl., Ex. 1012, ¶ 39.)
[14b] measuring drilling fluid pressure and bit weight;	Le Compte discloses measuring drilling fluid pressure. The drilling fluid pressure is measured using a slidable valve 84 in contact with a branch of the mud fluid line 82. (Le Compte, Ex. 1023, 5:51-112; 6:16-30; Fig. 15;

	Pinckard Decl., Ex. 1012, ¶ 93.) As the fluid pressure increases, the mud in the fluid line 82 causes the slidable valve 84 to open to a greater degree (and vice versa). (*Id.*) Crake discloses measuring bit weight. (Crake 3:36-51; Fig. 2; Pinckard Decl., Ex. 1012, ¶ 41.)
[14c] producing a first signal in response to changes in drilling fluid pressure, said first signal representing the changes in drilling fluid pressure;	Le Compte discloses the limitations of this step. Le Compte discloses that the slidable valve 84 opens or closes in response to changes in drilling fluid pressure. (Le Compte, Ex. 1023, 5:51-112; 6:16-30; Pinckard Decl., Ex. 1012, ¶ 94.) The slidable valve 84 dictates how much steam is allowed to pass to the brake controls, and thus the engagement of the brake. (*Id.*) Thus, the changes in drilling fluid pressure are indicated by the amount of steam that is allowed to pass to the brake controls. (*Id.*)
[14d] producing a second signal in response to changes in bit weight, said second signal representing the changes in bit weight;	Crake discloses the limitations of this step. A change in bit weight "results in a contraction of the Bourdon tube of the weight controller, which permits the pressure fluid to escape through channel 55, thereby relieving the pressure on the diaphragm 21 of fluid motor 28, and applying the brake 19 to slow down the bit feed rate . . . ." (Crake, Ex. 1015, 5:74-6:9; Pinckard Decl., Ex. 1012, ¶ 41.)
[14e] selecting any one of said first signal, said second signal, and both said first and said second signals to control the release of said drill string; and	Crake discloses "selecting" a signal representing changes in bit weight, a signal representing changes in rate of penetration, or both signals. (Crake, Ex. 1015, 5:66-6:26; Pinckard Decl., Ex. 1012, ¶ 95.) It would have been obvious to one of ordinary skill in the art at the time of the '142 invention to include a drilling fluid pressure controller to the control system of Crake based on the teachings of Le Compte. (Pinckard Decl., Ex. 1012, ¶ 95.) Upon addition of a drilling fluid pressure controller to the drill control system of Crake, the system would "select" between a signal generated by the weight controller, the drilling fluid pressure controller, or both in the same manner that Crake already discloses "selecting" between the signals generated by the weight controller and the speed controller. (*Id.*; Crake, Ex. 1015, 5:66-6:26.)
[14f] relaying said selected signal or	Crake discloses a drill that automatically regulates the release of the drill string in response to changes in bit

signals to a drill string controller which regulates the release said drill string in response to said selected signal or signals.	weight and rate of penetration. (Crake, Ex. 1015, 1:1-6; Pinckard Decl., Ex. 1012, ¶ 39.) It would have been obvious to one of ordinary skill in the art at the time of the '142 invention to include a drilling fluid pressure controller to the control system of Crake based on the teachings of Le Compte. (Pinckard Decl., Ex. 1012, ¶ 95.) Crake discloses that each of the controllers relays a signal to a drill string controller, which regulates the release of the drill string. (Crake, Ex. 1015, 5:66-6:26; Pinckard Decl., Ex. 1012, ¶ 96.) Thus, the combined system of Crake and Le Compte would do the same. (Pinckard Decl., Ex. 1012, ¶ 96.)

CONCLUSION

For the foregoing reasons, the Petitioner respectfully requests that a Trial be instituted and that claims 1, 11 and 14 be canceled.

Respectfully submitted,

Dated: May 3, 2013

By: /Kimberly K. Dodd/
Kimberly K. Dodd
Registration No. 54,646

Counsel for Petitioner

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing Petition for *Inter Partes* Review together with all exhibits and other papers filed therewith was served on May 3, 2013 by placing a copy into EXPRESS MAIL® directed to the attorneys of record for the patent at the following address:

Guy Matthews
The Matthews Firm
2000 Bering Drive, Suite 700
Houston, TX 77057

By: /Kimberly K. Dodd/
Kimberly K. Dodd
Registration No. 54,646
Counsel for Petitioner