

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:	§	
U.S. 5,474,142	§	Group Art Unit: 3993
	§	
Serial No: 90/010,615	§	Examiner: Peter C. English
	§	
Filed: July 24, 2009	§	Confirmation No: 8642
	§	
For: AUTOMATIC	§	Atty Docket: NOV-2RE:142
DRILLING SYSTEM	§	
	§	

RESPONSE TO FINAL OFFICE ACTION DATED FEBRUARY 22, 2010

Mail Stop *Ex Parte* Reexam
Attn: Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In Response to the Final Office Action, dated February 22, 2010, Patent Owner respectfully submits the following arguments in support thereof.

Status of Claims begins on Page 2 of this Response.

Remarks begin on Page 10 of this Response.

Status of Claims:

Claims 1-15 of U.S. Patent No. 5,474,142 (hereafter the "'142 Patent") are listed below:

1. (Currently Amended) 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:

a drilling fluid pressure sensor;

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;

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

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.

2. (Original) The automatic drilling system according to claim 1, further comprising:

a bit weight sensor;

a bit weight regulator coupled to said bit weight sensor, said bit weight regulator measuring changes in bit weight and outputting a signal representing those changes;

a relay coupled to said bit weight regulator, said relay responsive to the output signal of said bit weight regulator to supply a drill string control signal at an output thereof; and

said drill string controller coupled to said relay wherein a decrease in bit weight 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 and an increase in bit weight 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.

3. (Original) The automatic drilling system according to claim 1 further comprising:

a drill string torque sensor;

a drill string torque regulator coupled to said drill string torque sensor, said drill string torque regulator measuring changes in drill string torque and outputting a signal representing those changes;

a relay coupled to said drill string torque regulator, said relay responsive to the output signal of said drill string torque regulator to supply a drill string control signal at an output thereof; and

a drill strings controller coupled to said relay wherein a decrease in drill string torque results in said relay supplying a drill strings control signal that operates said drill strings controller to effect an increase in the rate of release of said drill string and an increase in drill string torque results in said relay supplying a drill strings control signal that operates said drill strings controller to effect a decrease in the rate of release of said drill string.

4. (Original) The automatic drilling system according to claim 1 further comprising:

a drill string RPM sensor;

a drill string RPM regulator coupled to said drill string RPM sensor, said drill string RPM regulator measuring changes in drill string RPM and outputting a signal representing those changes;

a relay coupled to said drill string RPM regulator, said relay responsive to the output signal of said drill string RPM regulator to supply a drill strings control signal at an output thereof; and

a drill strings controller coupled to said relay wherein an increase in drill string RPM results in said relay supplying a drill strings control signal that operates said drill strings controller to effect an increase in the rate of release of said drill string and a decrease in drill string RPM results in said relay supplying a drill strings control signal that operates said drill strings controller to effect a decrease in the rate of release of said drill string.

5. (Original) The automatic drilling system according to claim 1 wherein said drilling fluid pressure regulator, comprises:

a Bourdon tube coupled to said drilling fluid pressure sensor to measure changes in drilling fluid pressure;

a flapper coupled at one end to said Bourdon tube wherein said flapper pivots about a pivot point in response to changes in drilling fluid pressure measured by said Bourdon tube; and

means responsive to the pivoting of said flapper for outputting to said relay a signal representative of changes in drilling fluid pressure.

6. (Original) The automatic drilling system according to claim 2 wherein said bit weight regulator, comprises:

a Bourdon tube coupled to said bit weight sensor to measure changes in bit weight;

a flapper coupled at one end to said Bourdon tube wherein said flapper pivots about a pivot point in response to changes in bit weight measured by said Bourdon tube; and

means responsive to the pivoting of said flapper for outputting a signal to said relay representative of changes in bit weight.

7. (Original) The automatic drilling system according to claim 3 wherein said drill string torque regulator, comprises:

a Bourdon tube coupled to said drill string torque sensor to measure changes in drill string torque;

a flapper coupled at one end to said Bourdon tube wherein said flapper pivots about a pivot point in response to changes in drill string torque measured by said Bourdon tube;
and

means responsive to the pivoting of said flapper for outputting a signal to said relay representative of changes in drill string torque.

8. (Original) The automatic drilling system according to claim 4 wherein said drill string RPM regulator, comprises:

a Bourdon tube coupled to said drill string RPM sensor to measure changes in drill string RPM;

a flapper coupled at one end to said Bourdon tube wherein said flapper pivots about a pivot point in response to changes in drill string RPM measured by said Bourdon tube;
and

means responsive to the pivoting of said flapper for outputting a signal to said relay representative of changes in drill string RPM.

9. (Original) An automatic drilling system for automatically regulating the releasing of the drill string of a drilling rig during the drilling of a borehole, comprising:

a drilling fluid pressure sensor;

a bit weight sensor;

a drilling fluid pressure regulator responsive to changes in drilling fluid pressure for outputting a signal representative of those changes;

a bit weight regulator responsive to changes in bit weight for outputting a signal representative of those changes;

a first relay connected to said drilling fluid pressure regulator, said first relay responsive to the output signal of said drilling fluid pressure regulator to supply a first drill string control signal at an output thereof;

a second relay connected to said bit weight regulator, said first relay responsive to the output signal of said bit weight regulator to supply a second drill string control signal at an output thereof;

a relay selector connected to said first and second relay to select any one of said first drill string control signal, said second drill string control signal, and both of said first and second drill string control signals to control the release of said drill string; and

a drill string controller coupled to said first and second relays wherein when said first drill string control signal represents a decrease in drilling fluid pressure, said drill string controller increases the rate of release of said drill string and when said first drill string control signal represents an increase in drilling fluid pressure, said drill string controller increases the rate of release of said drill string, and further wherein when said second drill string control signal represents a decrease in bit weight, said drill string controller decreases the rate of release of said drill string and when said second drill string control signal represents an increase in bit weight, said drill string controller decreases the rate of release of said drill string.

10. (Original) The automatic drilling system according to claim 9, further comprising:

a drill string torque sensor;

a drill string RPM sensor;

a drill string torque regulator responsive to changes in drill string torque for outputting a signal representative of those changes;

a drill string RPM regulator responsive to changes in drill string RPM for outputting a signal representative of those changes;

a third relay connected to said drill string torque regulator, said third relay responsive to the output signal of said drill string torque regulator to supply a third drill string control signal at an output thereof;

a fourth relay connected to said drill string RPM regulator, said fourth relay responsive to the output signal of said drill string RPM regulator to supply a fourth drill string control signal at an output thereof;

said relay selector further connected to said third and fourth relays to select any one of said first, second, third, and fourth drill string control signals, a combination of said first, second, third, and fourth drill string control signals, and all of said first, second, third, and fourth drill string control signals to control the release of said drill string; and

said drill string controller coupled to said third and fourth relays wherein when said third drill string control signal represents a decrease in drill string torque, said drill string controller increases the rate of release of said drill string and when said third drill string control signal represents an increase in drill string torque, said drill string controller decreases the rate of release of said drill string, and further wherein when said fourth drill string control signal represents a increase in drill string RPM, said drill string controller increases the rate of release of said drill string and when said fourth drill string control signal represents a decrease in drill string RPM, said drill string controller decreases the rate of release of said drill string.

11. (Currently Amended) 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:

measuring drilling fluid pressure;

producing a signal in response to changes in drilling fluid pressure, said signal representing the changes in drilling fluid pressure;

relaying said signal to a drill string controller; and

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.

12. (Original) The method according to claim 11 further comprising the steps of:

measuring drill string torque;

producing a signal in response to changes in drill string torque, said signal representing the changes in drill string torque; and

relaying said signal to a drill string controller;

controlling said drill string controller to increase the rate of release of said drill string when said signal represents a decrease in drill string torque and to decrease the rate of release of said drill string when said signal represents an increase in drill string torque.

13. (Original) The method according to claim 11 further comprising the steps of:

measuring drill string RPM;

producing a signal in response to changes in drill string RPM, said signal representing the changes in drill string RPM;

relaying said signal to a drill string controller; and

controlling said drill string controller to increase the rate of release of said drill string when said signal represents a increase in drill string RPM and to decrease the rate of release of said drill string when said signal represents an decrease in drill string RPM.

14. (Original) A method for automatically regulating the release of the drill string of a drilling rig drill, comprising the steps of:

measuring drilling fluid pressure and bit weight;

producing a first signal in response to changes in drilling fluid pressure, said first signal representing the changes in drilling fluid pressure;

producing a second signal in response to changes in bit weight, said second signal representing the changes in bit weight;

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

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.

15. (Original) The method according to claim 14, further comprising the steps of:

measuring drill string torque and drill string RPM

producing a third signal in response to changes in drill string torque, wherein said third signal represents the changes in drill string torque;

producing a fourth signal in response to changes in drill string RPM, wherein said fourth signal represents the changes in drill string RPM;

selecting any one of said first, second, third, and fourth signals, a combination of said first, second, third, and fourth signals, and all of said first, second, third, and fourth signals to regulate the release of said drill string; and

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.

REMARKS

Patent Owner and the undersigned thank Examiner English for his careful review of this application. Consideration of the present application in view of the following remarks is respectfully requested.

I. Disposition of Claims

Claims 1-8 and 11-15 are subject to reexamination.

Claims 9-10 are not subject to reexamination.

Claims 2-8 and 12-15 were deemed patentable and/or confirmed.

Claims 1 and 11 are rejected and are currently amended by way of this response.

Specifically, Claim 1 and Claim 11 have been amended to clarify that measurements of drilling fluid pressure, and control signals generated responsive to these measurements, relate to drilling fluid pressure measured and used to control the rate of release of a drill string, with direct effect at a drill bit associated with the drill string. Support for this amendment can be found throughout the specification and figures of the '142 Patent, such as, for example, the description at [Column 10, Lines 4-14.]

It is respectfully requested that this amendment subsequent to the Final Office Action mailed February 22, 2010 be entered and considered, under 37 CFR §1.116, for at least the following reasons:

1. The Examiner's interpretation of the original claim language, and that of the cited references, clarified in the response to Patent Owner's arguments (*See* Final Office Action, Page 6), provided the impetus to amend the claims to more clearly describe the function of the claimed elements. Further, Patent Owner believed that the previous response placed Claims 1 and 11 in

condition for allowance, for at least the reasons set forth in the previous response. As such, the present amendment was not presented earlier.

2. The present amendment clarifies the function of the claimed elements, narrows issues for consideration, and does not significantly alter the scope of the claims. It is therefore believed that the amendment should require only cursory review and consequently, should not require further search by the Examiner. Additionally, Patent Owner submits that the present amendment places Claims 1 and 11 in condition for allowance over the cited references.
3. It is believed that the clarification to the function of the claimed elements added through the present amendment places the claims in better form for consideration on appeal. The amendment clarifies and/or narrows the issues for consideration.

Accordingly, entry and consideration of the present amendment, as an earnest attempt to advance prosecution and reduce the number of issues, is respectfully requested under 37 CFR §1.116.

II. History of Reexamination of 5,474,142

The preceding Office Action, dated December 14, 2009, rejected Claims 1 and 11 under 35 USC §102(b) as being anticipated by LeCompte et al., and Claims 1, 5, and 11-15 under 35 USC §103(a) as being obvious over Bowden '359 in view of Dillon et al. and Hobhouse.

Responsive to the rejection under 35 USC §103, Patent Owner submitted a detailed showing of secondary considerations, in addition to other arguments. Patent Owner thanks the Examiner for the withdrawal of the rejection under 35 USC §103 in the present Office Action.

Responsive to the rejection under 35 USC §102, Patent Owner argued, in part, that LeCompte describes a system which controls release of only an upper section of a drill stem, and not the drill string, as recited by Claims 1 and 11. Specifically, the

telescoping joint of LeCompte prevents the release or retention of the upper section of the drill stem from affecting any portion of the drill stem or drill bit disposed beneath the telescoping joint. LeCompte describes a braking mechanism for a drilling apparatus intended for use during vertical drilling, which is used to ensure that a predetermined weight is continuously applied to the drill bit, and that the predetermined weight is never exceeded. (“...our primary aim is, at all times, to maintain a predetermined pressure, by weight of a lower section of drill stem on the bit, and no more...” *See* LeCompte, Page 2, ll. 92-25). The braking mechanism of LeCompte controls the rate of release of the upper drill stem solely to keep pace with, but not control, the rate of release of the lower drill stem. It was submitted that this does not constitute controlling the rate of release of the drill string in response to changes in drilling fluid pressure as recited in Claims 1 and 11.

The current Office Action maintained the rejection of Claims 1 and 11 under 35 USC §102(b), the Examiner noting that: 1) Claims 1 and 11 do not specifically recite release of the “entire” drill string, 2) the plurality of connected drill stems described by LeCompte constitute a “drill string,” as broadly claimed, and 3) during normal operation, when the telescoping section is not collapsed, LeCompte releases the “entire” drill string.

Patent Owner has presented the above amendments and the following remarks to further clarify the argument previously submitted, and to amend the claims in a manner that corresponds with the Examiner’s interpretation of the claim language and that of the cited reference.

III. Claim Rejections – 35 USC §102

Claims 1 and 11 stand rejected under 35 USC §102(b) as being anticipated by LeCompte et al. (US 1,891,329) (hereafter “LeCompte”). This rejection is respectfully traversed.

Claim 1 and Claim 11 relate to an automatic drilling system and method that overcome the limitations of conventional weight on bit (WOB) drilling systems. While conventional WOB drilling systems are suitable for vertical drilling operations, during

which the weight applied to the drill bit is the most important variable when drilling, as directional and horizontal drilling have become commonplace, at least a portion of the drill string often rests on the slope of the directional wellbore, causing WOB measurements alone to be insufficient to regulate the rate at which the drill string, and the drill bit associated therewith, is released into the wellbore. (*See* '142 Patent, Col. 1, ll. 14-55).

Specifically, Claim 1, as amended, recites an automatic drilling system that includes a drilling fluid pressure sensor, and a drilling fluid pressure regulator coupled to the drilling fluid pressure sensor for measuring changes in drilling fluid pressure and outputting a signal representing those changes. A relay coupled to the drilling fluid pressure regulator supplies a drill string control signal responsive to the output signal of the drilling fluid pressure regulator. The drill string control signal is provided to a drill string controller coupled to the relay, such that a decrease in drilling fluid pressure results in the controller increasing the rate of release of the drill string, with direct effect at the drill bit associated therewith, and an increase in drilling fluid pressure results in the controller decreasing the rate of release of the drill string, with direct effect at the drill bit associated therewith.

Claim 11, as amended, recites a method for automatically regulating the release of the drill string that includes measuring drilling fluid pressure, producing a signal responsive to and representing these changes in drilling fluid pressure, relaying the signal to a drill string controller, and controlling the drill string controller to increase the rate of release of the drill string with direct effect at the drill bit associated therewith, when the signal represents a decrease in drilling fluid pressure, and to decrease the rate of release of the drill string, with direct effect at the drill bit associated therewith, when the signal represents an increase in drilling fluid pressure.

In contrast, LeCompte describes a braking mechanism for a drilling apparatus intended for use during vertical drilling, which is used to ensure that a predetermined weight is continuously applied to the drill bit, and that the predetermined weight is never exceeded. ("...our primary aim is, at all times, to maintain a predetermined pressure, by weight of a lower section of drill stem on the bit, and no more..." *See* LeCompte, Page 2, ll. 92-25). To

accomplish this, a telescoping section is placed between upper and lower drill stem sections, the weight of the lower drill stem section being the sole source for providing the predetermined weight to the drill bit. (LeCompte, Page 1, ll. 19-30 and Page 3, ll. 31-36). When the rate of penetration of the drill bit slows, the telescoping section is compressed by the continued motion of the upper portion of the drill stem, which prevents the upper portion of the drill stem from applying weight to the bit and generates a measurable back pressure, responsive to which flow to a steam cylinder is reduced to permit a brake band to slow or prevent lowering of the upper drill stem section. (LeCompte, Page 5, l. 97 – Page 6, l. 6). When the telescoping section is generally non-compressed, flow into the steam cylinder is permitted in sufficient quantity to set the brake band to permit lowering of the upper drill stem at a predetermined speed. (LeCompte, Page 5, Lines 82-96).

LeCompte fails to disclose or suggest each element of Claim 1 and Claim 11. Specifically, LeCompte does not disclose a drilling fluid pressure regulator measuring changes in drilling fluid pressure, and a drill string controller wherein a decrease in drilling fluid pressure results in an increase in the rate of release of the drill string with direct effect at the drill bit, and an increase in drilling fluid pressure results in a decrease in the rate of release of the drill string with direct effect at the drill bit.

Instead, LeCompte describes measurement of a back pressure created through compression of a telescoping section between drill stem sections. This back pressure is not used to regulate the rate of release of the drill string with direct effect at the drill bit, but instead is used to maintain a constant weight on bit in proportion to the predetermined weight of the lower drill stem section. LeCompte's telescoping joint is used to keep the bit "entirely safe from the weight of the upper drill stem at all times so that a predetermined weight can always be applied to the bit as recommended by the manufacturers of the bit for the various earth formations." See LeCompte, Page 6, ll. 43-48. The drawworks of LeCompte does not control the rate of release of the drill string with direct effect at the drill bit associated with the drill string, but can only control the release of the upper drill stem suspended within the rig's mast. *Id.* Page 6, ll. 29-30 ("sliding valve 84 will be further closed to allow normal lowering of the upper drill stem section H"); Page 5, ll. 23-36 ("permit the cable drum to revolve at such speed as to lower upper drill stem into the hole"); Page 5, ll. 110-112 ("further set the brake and slow up feeding of upper drill

stem into the hole”). Because the lower drill stem containing the drill bit is connected to a telescoping joint, the drawworks does not regulate the release of the lower drill stem with direct effect at a drill bit associated with the drill string. The rate of release of the lower drill stem is not controlled by the braking mechanism on the rig floor in response to changes in drilling fluid pressure, but is instead controlled by the rate of penetration of the bit as it cuts through the earth. The braking mechanism on the rig floor is used to control the rate of release of only the upper drill stem in a way that attempts to keep pace with, but does not control, the rate of release of the lower drill stem with which the drill bit is associated. Release or retention of the upper drill stem segment described by LeCompte does not constitute controlling the rate of release of the drill string with direct effect at the drill bit associated with the drill string, in response to changes in drilling fluid pressure as recited in Claim 1 and Claim 11. Thus, LeCompte does not teach each element of Claim 1 and Claim 11.

It is submitted that LeCompte teaches away from this element of Claim 1 and Claim 11 by expressly preventing full extension or full compression of the telescoping joint in order to ensure that the predetermined weight provided to the drill bit by the lower drill stem section is constantly applied to the drill bit, and that no additional weight is applied owing to the release of the upper drill stem section. (“... at no time can the upper drill stem section come into contact and rest upon the lower drill stem section to add all its weight to the drilling bit ... [t]he bit is intended to be entirely safe from the weight of the upper drill stem at all times ...”) See Le Compte, Page 6, ll. 31-34; 43-46. Thus, a release of the upper drill stem is prevented from having a direct effect at the drill bit associated with the drill string. The telescoping section of LeCompte is provided between the upper and lower drill stem segments for the purpose of preventing application of any additional weight to the drill bit. Drilling fluid pressure is not measured or used to regulate or control the rate of release of the lower drill stem segment containing the drill bit and, therefore, is not used to regulate or control the rate of release of the drill string with direct effect at the drill bit associated therewith. LeCompte teaches away from Claim 1 and Claim 11 through the interposition of a telescoping joint above the lower drill stem segment associated with the drill bit, to maintain a constant weight on the drill bit proportional to the predetermined weight of the lower drill stem segment, unaffected by any changes in the rate of release of the upper drill stem segment above the telescoping joint. See Le Compte at Page 6, ll. 43-48.

IV. Conclusion

It is thereby submitted that for at least the reasons stated above, each claim of U.S. Patent 5,474,142 now stands in condition for allowance over the art of record. Reconsideration and withdrawal of the above rejections is respectfully requested.

Respectfully submitted,

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