



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/017,334	11/05/2019	10465463	36362.0150U3	6991

23859 7590 10/16/2019
Ballard Spahr LLP
SUITE 1000
999 PEACHTREE STREET
ATLANTA, GA 30309-3915

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

CHRISTOPHER L. DRENTH, Burlington, CANADA;
LONGYEAR TM, INC., SALT LAKE CITY, UT;
GORDON STEWART, Claremont, AUSTRALIA;
GLOBALTECH CORPORATION PTY LTD, CANNING VALE, WA;
KHALED HEJLEH, Peppermint Grove, AUSTRALIA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Document Description: Issue Fee Payment (PTO-85B)

Issue Fee Transmittal Form

Application Number	Filing Date	First Named Inventor	Atty. Docket No.	Confirmation No.
16017334	25-Jun-2018	CHRISTOPHER DRENTH	36362.0150U3	6991

TITLE OF INVENTION :

Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same

Entity Status	Application Type	Art Unit	Class - Subclass	EXAMINER
Regular Undiscounted	Utility under 35 USC 111(a)	3676	044000	MICHAEL WILLS III
Issue Fee Due	Publication Due	Total Fee(s) Due	Date Due	Prev. Paid Fee
\$1000	\$0	\$1000	30-Sep-2019	\$0

1.Change of Correspondence Address and/or Indication Of Fee Address (37 CFR 1.33 & 1.363)

Current Correspondence Address:	Current Indicated Fee Address :
23859 Ballard Spahr LLP SUITE 1000 999 PEACHTREE STREET ATLANTA GA 30309-3915 UNITED STATES 678-420-9300 ~~USpatentmail@ballardspahr.com~~	
☐ Change of correspondence address requested, system generated AIA/122-EFS form attached	☐ Fee Address indication requested, system generated SB/47-EFS form attached

2.Entity Status**Change in Entity Status**

Applicant certifying micro entity status; system generated Micro Entity certification form attached. See 37 CFR 1.29.

Note: Absent a valid certification of micro entity status, issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. If this box is checked, you will be prompted to choose a micro entity status on the gross income basis (37 CFR 1.29(a)) or the institution of higher education basis (37 CFR 1.29(d)), and make the applicable certification online.



Applicant asserting small entity status. See 37 CFR 1.27.

Note: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.



Applicant changing to regular undiscounted fee status.

Note: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.



Document Description: Issue Fee Payment (PTO-85B)

3.The Following Fee(s) Are Submitted:

☒ Issue Fee

☐ I authorize USPTO to apply my previously paid issue fee to the current fees due

☐ Publication Fee

☐ The Director is hereby authorized to apply my previously paid issue fee to the current fee due and to charge deficient fees to Deposit Account Number _____

☐ Advance Order - # of copies _____

☒ If **in addition to** the payment of the issue fee amount submitted with this form, there are any discrepancies in any amount(s) due, the Director is authorized to charge any deficiency, or credit any overpayment, to Deposit Account Number 140629 .

☐ The **issue fee must be submitted** with this form. **If payment of the issue fee does not accompany this form, checking this box and providing a deposit account number will NOT be effective to satisfy full payment of the fee(s) due.**

4.Firm and/or Attorney Names To Be Printed

NOTE: If no name is listed, no name will be printed
For printing on the patent front page, list to be displayed as entered

1. BALLARD SPAHR LLP
2.
3.

5.Assignee Name(s) and Residence Data To Be Printed

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

Name	City	State	Country	Category
LONGYEAR TM, INC.	Salt Lake City	UTAH	united states	corporation
GLOBALTECH CORPORATION PTY LTD	Canning Vale		australia	corporation

Document Description: Issue Fee Payment (PTO-85B)

6.Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via EFS-WEB on the date indicated below.

Signature	/Joseph P. Anderson III/	Date	09-27-2019
Name	Joseph P. Anderson	Registration Number	59245

Electronic Patent Application Fee Transmittal

Application Number:	16017334			
Filing Date:	25-Jun-2018			
Title of Invention:	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same			
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH			
Filer:	Joseph P. Anderson/Sharon DeLee			
Attorney Docket Number:	36362.0150U3			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1000

Electronic Acknowledgement Receipt

EFS ID:	37299894
Application Number:	16017334
International Application Number:	
Confirmation Number:	6991
Title of Invention:	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH
Customer Number:	23859
Filer:	Joseph P. Anderson/Sharon DeLee
Filer Authorized By:	Joseph P. Anderson
Attorney Docket Number:	36362.0150U3
Receipt Date:	27-SEP-2019
Filing Date:	25-JUN-2018
Time Stamp:	13:54:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1000
RAM confirmation Number	E20199QD54482995
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	Web85b.pdf	48745	no	3
			1e38ef2ec7d97558182c4c441b0b484e661c35db		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32097	no	2
			6572367576999f1a4263a49a89292ff51a66f890		
Warnings:					
Information:					
Total Files Size (in bytes):			80842		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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NOTICE OF ALLOWANCE AND FEE(S) DUE

23859 7590 06/28/2019
Ballard Spahr LLP
SUITE 1000
999 PEACHTREE STREET
ATLANTA, GA 30309-3915

EXAMINER

WILLS III, MICHAEL R

ART UNIT

PAPER NUMBER

3676

DATE MAILED: 06/28/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/017,334	06/25/2018	CHRISTOPHER L. DRENTH	36362.0150U3	6991

TITLE OF INVENTION: Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	09/30/2019

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

23859 7590 06/28/2019
Ballard Spahr LLP
SUITE 1000
999 PEACHTREE STREET
ATLANTA, GA 30309-3915

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/017,334	06/25/2018	CHRISTOPHER L. DRENT	36362.0150U3	6991

TITLE OF INVENTION: Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	09/30/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
WILLS III, MICHAEL R	3676	175-044000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/017,334	06/25/2018	CHRISTOPHER L. DRENTH	36362.0150U3	6991
23859	7590	06/28/2019	EXAMINER	
Ballard Spahr LLP SUITE 1000 999 PEACHTREE STREET ATLANTA, GA 30309-3915			WILLS III, MICHAEL R	
			ART UNIT	PAPER NUMBER
			3676	

DATE MAILED: 06/28/2019

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/017,334	Applicant(s) DRENTH et al.	
	Examiner MICHAEL R WILLS III	Art Unit 3676	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to remarks filed June 12, 2019.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-3 and 5-26. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____. 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.	5. ☐ Examiner's Amendment/Comment 6. ☐ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
--	---

/MICHAEL R WILLS III/
Primary Examiner, Art Unit 3676

<i>Search Notes</i> 	Application/Control No. 16/017,334	Applicant(s)/Patent Under Reexamination DRENTH et al.
	Examiner MICHAEL R WILLS III	Art Unit 3676

CPC - Searched*		
Symbol	Date	Examiner
E21B25/16	03/01/2019	MW

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
See East Search History	03/01/2019	MW
Forward/Backward Search	03/01/2019	MW
Inventor Name Search	03/01/2019	MW
Updated Search	06/24/2019	MW

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	See East Search History	06/24/2019	MW

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Issue Classification 	Application/Control No. 16/017,334	Applicant(s)/Patent Under Reexamination DRENTH et al.
	Examiner MICHAEL R WILLS III	Art Unit 3676

CPC			
Symbol			Type
E21B	/	25	/ 16
			F
			2013-01-01

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
/	/			

NONE (Assistant Examiner) (Date)		Total Claims Allowed: 25	
/MICHAEL R WILLS III/ Primary Examiner, Art Unit 3676 (Primary Examiner) (Date)		24 June 2019 O.G. Print Claim(s)	1 O.G. Print Figure

<i>Issue Classification</i> 	Application/Control No. 16/017,334	Applicant(s)/Patent Under Reexamination DRENTH et al.
	Examiner MICHAEL R WILLS III	Art Unit 3676

INTERNATIONAL CLASSIFICATION			
CLAIMED			
E21B	/	25	/ 16
NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	25	
/MICHAEL R WILLS III/ Primary Examiner, Art Unit 3676	24 June 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	8

Issue Classification 	Application/Control No. 16/017,334	Applicant(s)/Patent Under Reexamination DRENTH et al.
	Examiner MICHAEL R WILLS III	Art Unit 3676

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	18	11	21	20										
2	2	7	12	22	21										
3	3	8	13	23	22										
4	5	9	14	24	23										
5	6	10	15	25	24										
6	7	11	16	14	25										
13	8	12	17	15	26										
16	9	19	18												
17	10	20	19												

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 25	
/MICHAEL R WILLS III/ Primary Examiner, Art Unit 3676 (Primary Examiner) _____ (Date) _____		O.G. Print Claim(s) 1	O.G. Print Figure 8

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	"16017334"	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/06/24 00:58
L2	3	"14692484"	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/06/24 01:00
L8	3	cavity and wire line and port and window and electronic instrument and sensor and power source and transmitter	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/06/24 01:24
L9	217	E21B25/16.cpc.	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/06/24 01:24
S1	1	"14692484"	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/06/16 07:57
S2	79	((("DRENTH") near3 ("CHRISTOPHER")).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 12:08
S3	145	((("STEWART") near3 ("GORDON")).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 12:21
S4	47	((("STEWART") near3 ("GORDON")).INV.	EPO; JPO; DERWENT	ADJ	ON	2017/08/10 12:21
S5	7	((("HEJLEH") near3 ("KHALED")).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 14:08
S6	2	("20120145461" "6732818").PN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 15:04
S7	201	(E21B25/16).cpc.	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 15:07
S8	440855	(power source or battery) and (body or housing)and (instrument or sensor)	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 16:21
S9	0	WO "2008113127"	US-PGPUB;	ADJ	ON	2017/08/11 10:41

			USPAT; USOCR			
S10	3	"2008113127"	US- PGPUB; USPAT; USOCR; DERWENT	ADJ	ON	2017/08/11 10:41
S11	201	(E21B25/16).cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:12
S12	48	S11 and (battery or power source)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:12
S13	3	(US-20150300162-\$ or US-20150136488-\$ or US-20150029035-\$).did.	US-PGPUB	ADJ	ON	2017/08/11 11:15
S14	3	S13 and (battery or power source)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:15
S15	3	S13 and (battery or power source or power supply)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:19
S16	48	S11 and (battery or power source or power supply)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:19
S17	21	S11 and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:45
S18	0	702/2.cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:46
S19	921	702/2.ccls.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:46
S20	236	S19 and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:46
S21	8	S19 and window and core\$3 and orientat\$3	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:47
S22	606	E21B\$.cpc.and window and core\$3 and orientat\$3 and (battery or power source or power supply)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:48
S23	606	E21B\$.cpc. and window and core\$3 and orientat\$3 and (battery or power source or power supply)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:48
S24	263	E21B\$.cpc. and window and core\$3 and	US-	ADJ	ON	2017/08/11

		orientat\$3 and (battery or power source or power supply) and wireline	PGPUB; USPAT; USOCR			11:54
S25	300	E21B\$.cpc. and window and core\$3 and orientat\$3 and (battery or power source or power supply) and (wireline or wire line)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:54
S26	346	E21B\$.cpc. and window and cor\$3 and orientat\$3 and (battery or power source or power supply) and (wireline or wire line)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 12:07
S27	1730	window and cor\$3 and orientat\$3 and (battery or power source or power supply) and (wireline or wire line)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 12:08
S28	114	S27 AND ((E21B17/028 OR E21B47/09 OR E21B25/16).CPC.)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 12:20
S29	2	("20120145461" "6732818").PN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:07
S30	0	("2012/0145461").URPN.	USPAT	ADJ	ON	2017/08/12 14:07
S31	20	("1701724" "1773915" "2120240" "2489566" "2974739" "3059707" "3148740" "3207239" "4128134" "4558749" "4883131").PN. OR ("6732818").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:07
S32	28	("20040036474" "3618221" "3875796" "4128134" "4311201" "4389792" "4765414" "4883131" "5048619" "5052502" "5105894" "5310013" "6006844" "6082453" "6412575" "6592875" "6659196" "6732818" "6871410" "7296638").PN. OR ("7584055").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:07
S33	38	("1773915" "2652232" "3115196" "5957221").PN. OR ("7296638").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:08
S34	846	E21B25/00.cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:09
S35	9	S34 and window and core\$3 and orientat\$3	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:09
S36	69	S34 and core\$3 and orientat\$3	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:09
S37	38	("1773915" "2652232" "3115196" "5957221").PN. OR ("7296638").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:10
S38	101	("2489566" "2735652" "2820610"	US-	ADJ	ON	2017/08/12

		"3059707" "3127943" "3481412" "3548958" "4601354" "4765414" "4815342" "4955438" "4981183" "4982802" "5009273" "5010765" "5010789" "5020612" "5029653" "5038873" "5042596" "5090492" "5099934" "5103921" "5109935" "5111892" "5119892" "5131478" "5165494" "5178222" "5253720" "5322135" "5339915" "5351765" "5448227" "5568838").PN. OR ("6006844").URPN.	PGPUB; USPAT; USOCR			14:11
S39	40	("2820610" "3059707" "3346059" "4515225" "4562560" "4715022" "4765414").PN. OR ("4955438").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:11
S40	0	("2015/0300162").URPN.	USPAT	ADJ	ON	2017/08/12 14:11
S41	0	("2015/0136488").URPN.	USPAT	ADJ	ON	2017/08/12 14:11
S42	0	("2015/0029035").URPN.	USPAT	ADJ	ON	2017/08/12 14:11
S43	1	"14962484"	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:20
S44	12	"5601152"	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:22
S45	1	"14692484"	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:30
S46	203	(E21B25/16).cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:35
S47	0	core barrel and cavity and electronic instrument and sensor and power source and core and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:37
S48	1	core barrel and cavity and electronic instrument and sensor and power source and core and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:37
S49	1	core barrel and cavity and orientation and sensor and power source and core and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:38
S50	4551	cavity and orientation and sensor and power source and core and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:38
S51	141	electronic instrument and cavity and orientation and sensor and power source and core and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:39
S56	2	("2944792").PN.	US-	ADJ	ON	2018/02/17

			PGPUB; USPAT; USOCR			15:54
S57	204	(E21B25/16).cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2018/02/17 15:57
S64	3	"14692484"	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 09:35
S65	296	((("DRENTH") near3 ("CHRISTOPHER")) OR (("STEWART") near3 ("GORDON")) OR (("HEJLEH") near3 ("KHALED")))).INV.	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2019/03/01 09:36
S66	213	(E21B25/16).cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 09:38
S67	0	WO "20133126955"	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 10:15
S68	6	(US-20150300162-\$ or US-20150136488-\$ or US-20150029035-\$).did. or (US- 6006844-\$ or US-4955438-\$ or US- 7296638-\$).did.	US- PGPUB; USPAT	ADJ	ON	2019/03/01 10:17
S69	3	S68 and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 10:17
S70	21	(US-0145461-\$ US-0300162-\$ US- 10047581-\$ US-15782230-\$ US- 1626126-\$ US-2944792-\$ US- 2134921-\$ US-2243173-\$ US- 3134600-\$ US-4955438-\$ US- 5601152-\$ US-6732818-\$ US- 7296638-\$ US-20120145461-\$ US- 20150300162-\$).DID.	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:09
S71	39	("1773915" "2652232" "3115196" "5957221").PN. OR ("7296638").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:17
S72	20	("3049185" "3194326" "3333647" "4279315" "4558749").PN. OR ("5601152").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:17
S73	34	("1752388" "1867024" "1870696" "20010013429" "20040065482" "20050025594" "20090317202" "20100054884" "20120241223" "2484365" "2689109" "2708103" "3140749" "3517754" "4848454" "4951761" "5161859" "5601152" "6698981" "6799648" "7281594" "7296641" "8763282" "8960336" "9162371").PN. OR ("D826299").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:17
S74	39	("1773915" "2652232" "3115196"	US-	ADJ	ON	2019/03/01

		"5957221").PN. OR ("7296638").URPN.	PGPUB; USPAT; USOCR			11:18
S75	7	("20120145461" "2944792" "4955438" "5601152" "6732818" "7296638").PN. OR ("10047581").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:18
S76	0	(S68 or S70) and pressure fitting	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:22
S77	2	(S68 or S70) and pressure fitting	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:22
S78	4	(S68 or S70) and fitting	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:24
S79	2	(S68 or S70) and port same check valve	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:24
S80	11	(S66) and port same check valve	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:33
S81	3	S66 and pressure fitting	US- PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:33

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	80	electronic instrument and cavity and orientation and sensor and power source and core and window and orientation and port and cavity	USPAT	ADJ	ON	2019/06/24 01:21
L4	0	electronic instrument and cavity and orientation and sensor and power source and core and window and orientation and port and cavity and core barrell head assembly	USPAT	ADJ	ON	2019/06/24 01:22
L5	80	electronic instrument and cavity and orientation and sensor and power source and core and window and orientation and port and base	USPAT	ADJ	ON	2019/06/24 01:22
L6	57	electronic instrument and cavity and orientation and sensor and power source and core and window and orientation and port and transmitter	USPAT	ADJ	ON	2019/06/24 01:22
L7	1	cavity and wire line and port and window and electronic instrument and sensor and power source and transmitter	USPAT	ADJ	ON	2019/06/24 01:24
S52	0	core barrel and cavity and electronic instrument and sensor and power source and core and window	USPAT	ADJ	ON	2017/10/30 11:37

S53	0	core barrel and cavity and orientation and sensor and power source and core and window	USPAT	ADJ	ON	2017/10/30 11:38
S54	1848	cavity and orientation and sensor and power source and core and window	USPAT	ADJ	ON	2017/10/30 11:38
S55	72	electronic instrument and cavity and orientation and sensor and power source and core and window	USPAT	ADJ	ON	2017/10/30 11:39
S58	73	electronic instrument and cavity and orientation and sensor and power source and core and window	USPAT	ADJ	ON	2018/02/17 15:57
S59	0	electronic instrument and cavity and orientation and sensor and power source and core and window and (wireline or wire line) and orientation	USPAT	ADJ	ON	2018/02/17 15:59
S60	0	electronic instrument and cavity and orientation and sensor and power source and core and window and (wireline or wire line)	USPAT	ADJ	ON	2018/02/17 15:59
S61	73	electronic instrument and cavity and orientation and sensor and power source and core and window and orientation	USPAT	ADJ	ON	2018/02/17 15:59
S62	71	electronic instrument and cavity and orientation and sensor and power source and core and window and orientation and port	USPAT	ADJ	ON	2018/02/17 15:59
S63	71	electronic instrument and cavity and orientation and sensor and power source and core and window and orientation and port and cavity	USPAT	ADJ	ON	2018/02/17 16:00

6/ 24/ 2019 1:25:20 AM
C:\ Users\ mwills1\ Documents\ EAST\ Workspaces\ 16017334.wsp

PTO/SB/08a (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/017,334
				Filing Date	June 25, 2018
				First Named Inventor	Christopher L. Drenth
				Art Unit	3676
				Examiner Name	Not Yet Assigned
				Attorney Docket Number	36362.0150U3
Sheet	1	of	3		

[illegible]

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ⁶
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	A**	EP 2134921	12-23-2009	2iC Australia Pty Ltd.		
	B**	GB 2243173	10-23-1991	Seafloors Eng Inc		
	C**	WO 2006/024111	03-09-2006	Australia Mud Co Ltd.		
	D**	WO 2007/104103	09-20-2007	2iC Australia Pty Ltd.		
	E**	WO 2007/137356	12-06-2007	2iC Australia Pty Ltd.		
	F**	WO 2008/113127	09-252008	2iC Australia Pty Ltd.		

Examiner Signature		Date Considered	
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EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with 37 CFR § 1.6(a)(4).

Dated: October 11, 2018 Electronic Signature: Joseph P. Anderson, III/ (Joseph P. Anderson, III)

PTO/SB/08b (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Application Number	16/017,334
				Filing Date	June 25, 2018
				First Named Inventor	Christopher L. Drenth
				Art Unit	3676
				Examiner Name	Not Yet Assigned
Sheet	3	of	3	Attorney Docket Number	36362.0150U3

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	A**	International Search Report and Written Opinion were mailed on 7/24/2015 by the International Searching Authority for International Application No. PCT/US2015/026907, filed on 4/21/2015 and published as WO 2015/164394 on 10/29/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket- 36362.0150P1) (11 Pages)	
	B	International Preliminary Report on Patentability was mailed on 10/25/2016 by the International Searching Authority for International Application No. PCT/US2015/026907, filed on 4/21/2015 and published as WO 2015/164394 on 10/29/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket- 36362.0150P1) (9 Pages)	
	C**	Third Party Observations dated August 17, 2016 for International Patent Application No. PCT/US2015/026907 (Applicant- Longyear TM, Inc.) (42 pages)	
	D	Examination Report was issued on 8/14/2018 by the Australian Patent Office for AU Application No. 2015249889, which was filed on 4/21/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150AU1) (3 pages)	
	E	Office Action was issued on 7/11/2018 by the Chilean Patent Office for CL Application No. 2016-002684, which was filed on 4/21/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150CL1) (3 pages)	
	F**	Extended European Search Report issued on 10/17/2017 by the European Patent Office for Application No. 15782230.5, which was filed on April 21, 2015 and published as EP 3134600 on March 1, 2017 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150EP1) (9 pages)	
	G	Preliminary Amendment was mailed on 2/28/2017 to the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (7 pages)	
	H	Non Final Rejection was issued on 8/18/2017 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (7 pages)	
	I	Response to Non Final Rejection was mailed on 10/18/2017 to the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (9 pages)	
	J	Notice of Allowance was issued on 11/8/2017 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (5 pages)	
	K	Notice of Allowance was issued on 4/12/2018 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (7 pages)	
	L	Issue Notification was issued on 7/25/2018 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (1 page)	
Examiner Signature	/MICHAEL R WILLS III/		Date Considered 06/24/2019

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹Applicant's unique citation designation number (optional). ²Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.R.W/

REFLEX EXHIBIT 1011 - 27/225

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/017,334		Filing Date 06/25/2018		☐ To be Mailed					
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO													
APPLICATION AS FILED - PART I													
		(Column 1)	(Column 2)										
FOR		NUMBER FILED	NUMBER EXTRA		RATE (\$)		FEE (\$)						
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A		N/A								
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A	N/A		N/A								
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A		N/A								
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 = *		x \$100 =									
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *		x \$460 =									
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).											
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))													
* If the difference in column 1 is less than zero, enter "0" in column 2.					TOTAL								
APPLICATION AS AMENDED - PART II													
		(Column 1)	(Column 2)		(Column 3)								
AMENDMENT	06/12/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)						
	Total (37 CFR 1.16(i))	* 25	Minus	** 21	= 4	x \$100 =	400						
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0	x \$460 =	0						
	☐ Application Size Fee (37 CFR 1.16(s))												
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))												
							TOTAL ADD'L FEE		400				
		(Column 1)	(Column 2)		(Column 3)								
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)						
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =							
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =							
	☐ Application Size Fee (37 CFR 1.16(s))												
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))												
							TOTAL ADD'L FEE						
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.							LIE						
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".							/VENICE M WILLIAMS/						
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".													
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.													

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	)	
	)	
DRENTH et al.	)	Art Unit: 3676
	)	
Application No.: 16/017,334	)	Examiner: Wills III, Michael R.
	)	
Filing Date: June 25, 2018	)	Confirmation No.: 6991
	)	
FOR: CORE BARREL HEAD ASSEMBLY	)	
WITH AN INTEGRATED SAMPLE	)	
ORIENTATION TOOL AND	)	
SYSTEM FOR USING SAME	)	

RESPONSE TO NON-FINAL OFFICE ACTION

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Ballard Spahr LLP
Customer Number 23859

June 12, 2019

Commissioner:

In response to the Office Action dated March 14, 2019 (the "Office Action"), please amend the above-referenced application as set forth below and consider the Remarks that follow.

Amendments to the Specification are reflected on page 2 of this Amendment.

Amendments to the Claims are reflected on the listing of claims which begins on page 3 of this Amendment.

Remarks begin on page 7 of this Amendment.

AMENDMENTS TO THE SPECIFICATION

Please replace paragraph [0051] of the as-filed application with the following paragraph:

Alternatively, flashing lights may be used, such as, for example and without limitation, a certain frequency or number of flashes for one direction and another frequency or number of flashes for the other direction of rotation. A steady light could be given when correct orientation is achieved. Thus, advantageously, when the core barrel head assembly 30 and the core sample are recovered from down the hole, the core barrel head assembly 30 need not be separated from the drill string in order to determine a required orientation of the core sample. Wireless communication to a remote device, such as a hand held device, to transfer data between the core barrel head assembly and the remote device, can also be effected by transmitting through [[the]] at least one ~~aperture~~ window.

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A core barrel head assembly[[,]] having an exterior surface and comprising:

~~an elongate tube body defining a first interior cavity; [[and]]~~

a selectively sealed interior cavity spaced distally from the first interior cavity and having a closed proximal end, wherein the elongate tube body has:

a threaded proximal end portion for coupling to a wire line retrieval portion of a head assembly;

a base portion, wherein the first interior cavity extends distally from the threaded proximal end portion to [[a]] the base portion of the elongate tube body, and wherein the elongate tube body further defines:

a port positioned proximate the base portion and extending from the exterior surface ~~of the elongate tube body~~ into fluid communication with the first interior cavity;

a window that extends from the exterior surface into optical communication with the sealed interior cavity proximate the closed proximal end of the sealed interior cavity;

at least one electronic instrument that is configured to obtain orientation data mounted therein the sealed interior cavity, wherein the at least one electronic instrument comprises at least one digital and/or electro-mechanical sensor[[s]] in a core orientation data recording tool that can be configured to determine a core orientation of a sample core just prior to or after [[the]] a core break;

a power source in operable communication with the at least one electronic instrument, wherein the power source is mounted therein the interior cavity; and

~~communication means to receive and/or~~ a transmitter configured to transmit core orientation data,

wherein the sealed interior cavity is sized and shaped to hermetically enclose the at least one electronic instrument and the power source.

2. (Currently Amended) The core barrel head assembly of Claim 1, wherein a pressure grease fitting is mounted in the port to allow for selective passage of ~~fluid~~ grease or other

lubricant to and from the exterior surface of the barrel head assembly into communication with the first interior cavity.

3. (Currently Amended) The core barrel head assembly of Claim 1, wherein the sealed interior cavity is sized and shaped to hermetically enclose the ~~communication means to receive and/or transmit orientation data~~ transmitter.

4. (Canceled)

5. (Currently Amended) The core barrel head assembly of Claim ~~[[4]]~~ 1, further comprising an orientation indicator module comprising a ~~plurality of light emitters~~ a light emitter.

6. (Currently Amended) The core barrel head assembly of Claim 5, wherein the core barrel head assembly comprises a plurality of windows that extend from the exterior surface into optical communication with the sealed interior cavity proximate the closed proximal end of the sealed interior cavity, wherein the orientation indicator module is sized and shaped to sealingly close the sealed interior cavity from any intrusion of pressurized fluid into the sealed interior cavity via the plurality of windows.

7. (Currently Amended) The core barrel head assembly of Claim ~~[[5]]~~ 6, wherein the orientation indicator module is configured to orient or otherwise position the plurality of light emitters so that each light emitter underlies one window.

8. (Currently Amended) The core barrel head assembly of Claim ~~[[5]]~~ 6, wherein the orientation indicator module further comprises at least one first O-ring seal for preventing any pressurized fluid from entering the sealed interior cavity from the plurality of windows ~~defined in the elongate tube body~~, wherein the at least one first O-ring seal is mounted on an exterior portion of the orientation indicator module and is configured to seal between an exterior portion of the orientation indicator module and a portion of an interior surface of the sealed interior cavity.

9. (Currently Amended) The core barrel head assembly of Claim 1, further comprising an open and threaded distal end portion, wherein the sealed interior cavity extends distally to ~~[[an]] the open and threaded distal end portion of the elongate tube body~~ core barrel head assembly.

10. (Currently Amended) The core barrel head assembly of Claim 9, further comprising a seal coupler that is configured to be sealingly received in the open threaded distal end portion of the ~~elongate tube body~~ core barrel head assembly.

11. (Currently Amended) The core barrel head assembly of Claim 10, further comprising at least one second O-ring seal for preventing any pressurized fluid from entering the sealed interior cavity, wherein the at least one second O-ring seal is mounted on a portion of the seal coupler and is configured to seal between a portion of the seal coupler and a portion of an interior surface of the open and threaded distal end portion of the ~~elongate tube body~~ core barrel head assembly.

12. (Original) The core barrel head assembly of Claim 7, further comprising a check valve assembly configured to affect a hermetical seal of the sealed interior cavity and to provide fluid control for wire line operation.

13. (Original) The core barrel head assembly of Claim 12, wherein the check valve assembly comprises a coupled proximal end assembly and a distally tapered seat that defines an interior chamber for operative receipt of a check ball.

14. (Currently Amended) The core barrel head assembly of Claim 13, further comprising a distal end portion, wherein the proximal end assembly of the check valve assembly defines a female threaded coupling that is configured to be threadably coupled to male threads defined on an exterior surface of ~~[[a]]~~ the distal end portion of the ~~elongate tube body~~ core barrel head assembly.

15. (Original) The core barrel head assembly of Claim 13, wherein the interior chamber of the check valve assembly extends to a distal end of the check valve assembly, and wherein the check valve assembly further defines at least one port that extends from an exterior surface of the check valve assembly and is in fluid communication with the interior chamber of the check valve assembly.

16. (Original) The core barrel head assembly of Claim 15, wherein the interior chamber has a distally tapered seat that is adapted to selectively receive the check ball that is sized to selectively block the distally tapered seat.

17. (Original) The core barrel head assembly of Claim 16, wherein the interior chamber is sized and shaped to allow the check ball to selectively move axially between an open position, in which the check ball is spaced proximally away from the surface of the tapered seat so that pressurized fluid can move through the distal end of the check valve assembly and subsequently through the interior chamber to exit out of the at least one port, and a closed position, in which the check ball is pressurized against the surface of the tapered seat so that pressurized fluid cannot move through the check valve assembly.

18. (Currently Amended) The core barrel head assembly of Claim 1, wherein ~~[[an]] the exterior surface of the elongate tube body~~ defines a plurality of female planar stops ~~proximate the mid-body portion~~.

19. (Original) The core barrel head assembly of Claim 1, wherein the at least one electronic instrument is programmed to obtain orientation data when the at least one electronic instrument senses no relative movement of the at least one electronic instrument.

20. (Original) The core barrel head assembly of Claim 19, wherein the at least one electronic instrument is programmed to obtain orientation data when the at least one electronic instrument senses no vibrations, and wherein the at least one electronic instrument is programmed to not obtain orientation data when the at least one electronic instrument determines that the core barrel head assembly is in motion while descending down or ascending up the hole and during drilling.

21. (Original) The core barrel head assembly of Claim 1, wherein the at least one electronic instrument is programmed to obtain orientation data based on a predetermined time interval scheme.

22. (New) The core barrel head assembly of Claim 1, wherein the at least one electronic instrument is configured to obtain orientation data at random periods of time.

23. (New) The core barrel head assembly of Claim 1, wherein the at least one electronic instrument is programmed to:

record orientation data relating to an orientation of the at least electronic instrument in a borehole; and

receive an interrogation command from an external communication device.

24. (New) The core barrel head assembly of Claim 1, wherein the transmitter is configured to transmit core orientation data to a remote device through the window.

25. (New) The core barrel head assembly of Claim 5, wherein the light emitter underlies the window, and wherein following retrieval of the core barrel head assembly from down a borehole, the light emitter is configured to provide a visual indication that a desired rotational orientation of the core barrel head assembly has been achieved.

26. (New) The core barrel head assembly of Claim 25, wherein the light emitter is further configured to provide a visual indication that further rotation of the core barrel head assembly is required to reach the desired rotational orientation.

REMARKS

Claims 1-21 are pending. As set forth herein, Applicants have amended claims 1-3, 5-11, 14, and 18. Claim 4 has been canceled without prejudice, and new claims 22-26 have been added. Therefore, after entry of this amendment, claims 1-3 and 5-26 will be under consideration. No new matter has been added by these amendments.

Information Disclosure Statement

The Office Action indicates that the Information Disclosure Statement (IDS) filed on October 11, 2018, fails to comply with 37 C.F.R. §1.98(a)(2), which requires a legible copy of each foreign patent or non-patent literature document. Applicant respectfully disagrees. As noted in the transmittal letter accompanying the IDS, the documents marked with a double asterisk (**) were previously cited by or submitted to the Office during prosecution of the parent application (Application No. 14/692,484), which is relied upon for an earlier filing date. Accordingly, pursuant to 37 C.F.R. §1.98(d), Applicant respectfully requests that the references that were previously cited/considered with respect to the parent application likewise be considered here.

Objection to the Drawings

The drawings were objected to for failure to depict the “pressure fitting” recited in claim 2. As set forth herein, Applicant has amended claim 2 to recite a “grease fitting,” which is clearly depicted in the drawings. Accordingly, Applicant respectfully requests that this objection be withdrawn.

Double Patent Rejections

Claims 1-21 were rejected under 35 U.S.C. § 101 as claiming the same invention as that of claims 1-27 of prior U.S. Patent No. 10,047,581. Applicant respectfully traverses this rejection. Initially, Applicant notes that independent claim 1, as originally presented, is not coextensive in scope with any claim of U.S. Patent No. 10,047,581. The variation in scope between the pending claims and the previously issued claims is even more apparent when factoring in the amendments presented herein. Accordingly, Applicant respectfully requests that the statutory double patenting rejections be withdrawn.

Claims 1-21 were rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-27 of U.S. Patent No. 10,047,581. As requested by the Office Action, submitted herewith is an eTerminal Disclaimer to obviate the double patenting

rejection. Accordingly, Applicant respectfully requests that the nonstatutory double patenting rejections be withdrawn.

Rejections Under 35 U.S.C. § 103

Claims 1, 3, 9, and 18-21 were rejected under 35 U.S.C. § 103 as being unpatentable over International Patent Application Publication No. WO 2008/113127 to Beach (“Beach”) in view of U.S. Patent No. 4,955,438 to Juergens (“Juergens”).

As set forth herein, independent claim 1 has been amended to incorporate the limitation of “a window that extends from the exterior surface into optical communication with the sealed interior cavity proximate the closed proximal end of the sealed interior cavity.” Both Beach and Juergens are silent regarding the presence of such a window, and person of ordinary skill in the art would not have been motivated to modify the cited references to provide such a window.

Therefore, Applicant respectfully submits that independent claim 1, as amended, and its dependent claims are nonobvious over the cited references. Accordingly, Applicant respectfully requests that the rejections of claims 1, 3, 9, and 18-21 be withdrawn.

New Claims 22-26

New claims 22-26 depend from and include all the limitations of independent claim 1. Accordingly, for at least the reasons set forth above with respect to independent claim 1, it is believed that new claims 22-26 are in condition for allowance.

CONCLUSION

In view of the above amendments and/or remarks, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue. The Examiner is invited and encouraged to contact directly the undersigned if such contact may enhance the efficient prosecution of this application to issue.

An electronic payment in the amount of \$560.00, representing the large-entity fees for a terminal disclaimer and four excess claims over twenty, is submitted herewith. No additional fee(s) are believed due; however, the Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-0629.

Respectfully submitted,

Electronic signature: /Joseph P. Anderson, III/
Joseph P. Anderson, III
Registration No.: 59,245
BALLARD SPAHR LLP
Correspondence Customer Number: 23859

Electronic Patent Application Fee Transmittal				
Application Number:		16017334		
Filing Date:		25-Jun-2018		
Title of Invention:		Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		
First Named Inventor/Applicant Name:		CHRISTOPHER L. DRENTH		
Filer:		Joseph P. Anderson/Sharon DeLee		
Attorney Docket Number:		36362.0150U3		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	4	100	400
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				400

Electronic Acknowledgement Receipt

EFS ID:	36278651
Application Number:	16017334
International Application Number:	
Confirmation Number:	6991
Title of Invention:	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH
Customer Number:	23859
Filer:	Joseph P. Anderson/Sharon DeLee
Filer Authorized By:	Joseph P. Anderson
Attorney Docket Number:	36362.0150U3
Receipt Date:	12-JUN-2019
Filing Date:	25-JUN-2018
Time Stamp:	15:13:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 400
RAM confirmation Number	061319INTEFSW15143600
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		36362_0150U3_Response_to_NonFinal_Office_Action.PDF	137823	yes	9
			c6c2a60c4a333a1a76a71052ec7e469ce5fa0e75		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Specification		2	2	
	Claims		3	6	
	Applicant Arguments/Remarks Made in an Amendment		7	9	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30612	no	2
			a9ebf0e32b1653f4e0a159506a1c063f111f4a78		
Warnings:					
Information:					
Total Files Size (in bytes):			168435		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce	
Electronic Petition Request	TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT		
Application Number	16017334		
Filing Date	25-Jun-2018		
First Named Inventor	CHRISTOPHER DRENTH		
Attorney Docket Number	36362.0150U3		
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		
☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action ☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.			
Owner	Percent Interest		
Longyear TM, Inc.	50 %		
GlobalTech Corporation PTY LTD	50 %		
The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s) 10047581			

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:

- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

Applicant claims the following fee status:

- ☐ Small Entity
- ☐ Micro Entity
- ☒ Regular Undiscounted

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

☒ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Registration Number 59245

☐ A sole inventor

☐ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

☐ A joint inventor; all of whom are signing this request

Signature	/Joseph P. Anderson III/
Name	Joseph P. Anderson III

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	16017334			
Filing Date:	25-Jun-2018			
Title of Invention:	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same			
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH			
Filer:	Joseph P. Anderson/Sharon DeLee			
Attorney Docket Number:	36362.0150U3			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				160

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16017334

Filing Date: 25-Jun-2018

Applicant/Patent under Reexamination: DRENTH

Electronic Terminal Disclaimer filed on June 12, 2019

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	36278813
Application Number:	16017334
International Application Number:	
Confirmation Number:	6991
Title of Invention:	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH
Customer Number:	23859
Filer:	Joseph P. Anderson/Sharon DeLee
Filer Authorized By:	Joseph P. Anderson
Attorney Docket Number:	36362.0150U3
Receipt Date:	12-JUN-2019
Filing Date:	25-JUN-2018
Time Stamp:	15:10:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 160
RAM confirmation Number	061319INTEFSW15103300
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	34712	no	3
			af1533681759d03545c7324e457438c57d0962ed		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30642	no	2
			dd5f10c1db648f64e0e0ff06be4f0e756b11d3aa		
Warnings:					
Information:					
Total Files Size (in bytes):			65354		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/017,334	06/25/2018	CHRISTOPHER L. DRENTH	36362.0150U3	6991
23859	7590	03/14/2019		
Ballard Spahr LLP SUITE 1000 999 PEACHTREE STREET ATLANTA, GA 30309-3915			EXAMINER WILLS III, MICHAEL R	
			ART UNIT	PAPER NUMBER
			3676	
			NOTIFICATION DATE	DELIVERY MODE
			03/14/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USpatentmail@ballardspahr.com

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Information Disclosure Statement

2. The information disclosure statement filed October 11, 2018 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the pressure fitting in claim 2 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an

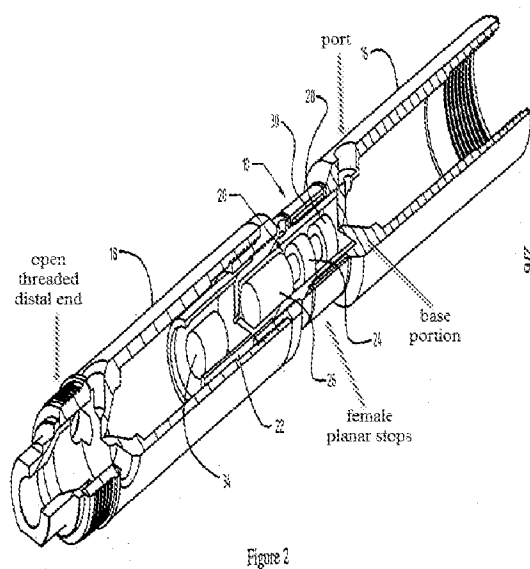
application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

5. **Claims 1, 3, 9 and 18-21 are rejected under 35 U.S.C. 103 as being unpatentable over Beach et al. WO 2008/113127 (Beach) in view of Juergens et al. US Patent 4,955,438 (Juergens).**



6. Regarding claim 1, Beach discloses a core barrel head assembly, comprising: an elongate tube body (**18, 16**) defining a first interior cavity (**16**) and a selectively sealed interior cavity (**18**)

spaced distally from the first interior cavity, wherein the elongate tube body has a threaded proximal end for coupling to a wire line retrieval portion of a head assembly (**Fig. 2**), wherein the first interior cavity extends distally from the threaded proximal end to a base portion (**illustrated in Fig. 2 above**), of the elongate tube body, and wherein the elongate tube body further defines a port (**illustrated in Fig. 2 above**) positioned proximate the base portion and extending from the exterior surface of the elongate tube body into fluid communication with the first interior cavity; at least one electronic instrument (**20**) that is configured to obtain orientation data mounted therein the sealed interior cavity (**pg. 11, lines 33-36**), wherein the at least one electronic instrument comprises at least one digital and/or electro-mechanical sensors (**pg. 12, lines 7-21**) in a core orientation data recording tool that can be configured to determine a core orientation of a sample core just prior to or after the core break (**pg. 12, lines 9-36**); a power source in operable communication with the at least one electronic instrument (**pg. 12, lines 9-13**); and communication means (**28, 30**) to receive and/or transmit core orientation data (**pg. 12, lines 25-28**). (**Fig. 2**).

The elongated tube in Beach has two sections, which are the adapter (**16**) and the core tube cap (**18**). Applicant discloses the elongated tube as an integral tube versus two separate tubes. Additionally, Beach teaches the core orientation tool (**10**) is battery powered. (**pg. 12, lines 9-13**). Beach does not disclose the power source is mounted therein the interior cavity, wherein the sealed interior cavity is sized and shaped to hermetically enclose the at least one electronic instrument and the power source.

Nonetheless, it would have been considered obvious to one of ordinary skill in the art, at the time the invention was made, to have made the elongated tube separable or modular, rather than unitary or integral, as it has been held that constructing a formerly integral structure as

various discrete elements involves only routine skill in the art. *Nerwin v. Erlichman*, 168 USPQ 177, 179; *In re Fridolph*, 309 F.2d 509, 50 CCPA 745; *In re Larson*, 52 C.C.P.A. 930, 340 F.2d 965, 144 USPQ 347 (CCPA 1965).

Furthermore, Juergens discloses a core drilling tool with a core pipe (20) that houses a measuring unit (10) that includes a power supply source unit (33). (col. 3, lines 50-52, Figs. 2-3).

Thus it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Beach so that the battery is in the enclosed tube with the electronic instrument as taught by Juergens for the purpose of providing power to the downhole components. This would achieve the predictable result of providing energy to the downhole components of the tool without the need of a wireline.

7. Regarding claim 3, Beach discloses the sealed interior cavity (18) is sized and shaped to hermetically enclose the communication means (28) to receive and/or transmit orientation data. (Fig. 2).

8. Regarding claim 9, Beach discloses the sealed interior cavity extends distally to an open threaded distal end of the elongate tube body. (Fig. 2 above).

9. Regarding claim 18, Beach discloses an exterior surface of the elongate tube body (18, 16) defines a plurality of female planar stops proximate the mid-body portion. (Fig. 2 above).

10. Regarding claim 19, Beach discloses the at least one electronic instrument (34) is programmed to obtain orientation data when the at least one electronic instrument senses no relative movement of the at least one electronic instrument. (pg. 17, lines 4-12). The gyroscope (34) tracks changes in orientation of the tool after drilling has stopped meaning there is no movement or vibrations.

11. Regarding claim 20, Beach discloses the at least one electronic instrument (34) is programmed to obtain orientation data when the at least one electronic instrument senses no vibrations (pg. 17, lines 4-12) (**The gyroscope 34 tracks changes in orientation of the tool after drilling has stopped meaning there is no movement or vibrations. Vibrations would occur during drilling.**), wherein the at least one electronic instrument (34) is programmed to not obtain orientation data when the at least one electronic instrument determines that the core barrel head assembly is in motion while descending down or ascending up the hole and during drilling. (pg. 17, lines 4-7).

12. Regarding claim 21, Beach discloses the at least one electronic instrument is programmed to obtain orientation data based on a predetermined time interval scheme. (pg. 19, lines 11-23).

Double Patenting

13. A rejection based on double patenting of the “same invention” type finds its support in the language of 35 U.S.C. 101 which states that “whoever invents or discovers any new and useful process... may obtain a patent therefor...” (Emphasis added). Thus, the term “same invention,” in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the claims that are directed to the same invention so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

14. Claims 1-21 are rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 1-27 of prior U.S. Patent No. 10,047,581. This is a statutory double patenting rejection.

15.

16. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the

form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

17. Claims 1-21 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-27 of U.S. Patent No. 10,047,581. Although the claims at issue are not identical, they are not patentably distinct from each other because they both are claiming a barrel head assembly comprising: an elongate tube body defining a first interior cavity and a selectively sealed interior cavity spaced distally from the first interior cavity, wherein the elongate tube body has a threaded proximal end for coupling to a wire line retrieval portion of a head assembly, wherein the first interior cavity extends distally from the threaded proximal end to a base portion of the elongate tube body, and wherein the elongate tube body further defines a port positioned proximate the base portion and extending from the exterior surface of the elongate tube body into fluid communication with the first interior cavity; at least one electronic instrument that is configured to obtain orientation data mounted therein the sealed interior cavity, wherein the at least one electronic instrument comprises at least one digital and/or electro-mechanical sensors in a core orientation data recording tool that can be configured to determine a core orientation of a sample core just prior to or after the core break; a power source in operable communication with the at least one electronic instrument, wherein the power source is mounted therein the interior cavity; and communication means to receive and/or transmit core orientation data, wherein the sealed interior cavity is sized and shaped to hermetically enclose the at least one electronic instrument and the power source. The only difference is U.S. Patent No.

10,047,581 includes the limitation a plurality of windows defined in the elongate tube body that extend from the exterior surface of the elongate tube body into optical communication with the sealed interior cavity proximate a closed proximal end of the sealed interior cavity. Which is claim 4 which depends from independent claim 1 of the current application.

Conclusion

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL R WILLS III whose telephone number is (571)272-5521. The examiner can normally be reached on Monday-Friday 8:30am to 5:00pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Waseem Moorad can be reached on 5712703436. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHAEL R WILLS III/
Primary Examiner, Art Unit 3676

<i>Search Notes</i> 	Application/Control No. 16/017,334	Applicant(s)/Patent Under Reexamination DRENTH et al.
	Examiner MICHAEL R WILLS III	Art Unit 3676

CPC - Searched*		
Symbol	Date	Examiner
E21B25/16	03/01/2019	MW

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
See East Search History	03/01/2019	MW
Forward/Backward Search	03/01/2019	MW
Inventor Name Search	03/01/2019	MW

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

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PTO/SB/08a (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/017,334
				Filing Date	June 25, 2018
				First Named Inventor	Christopher L. Drenth
				Art Unit	3676
				Examiner Name	Not Yet Assigned
				Attorney Docket Number	36362.0150U3
Sheet	1	of	3		

[illegible]

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ⁶
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	A**	EP 2134921	12-23-2009	2iC Australia Pty Ltd		
	B**	GB 2243173	10-23-1991	Seafloors Eng Inc		
	C**	WO 2006/024111	03-09-2006	Australia Mud Co Ltd.		
	D**	WO 2007/104103	09-20-2007	2iC Australia Pty Ltd.		
	E**	WO 2007/137356	12-06-2007	2iC Australia Pty Ltd		
	F**	WO 2008/113127	09-25-2008	2iC Australia Pty Ltd.		

Examiner Signature		Date Considered	
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EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 809. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with 37 CFR § 1.6(a)(4).

Dated: October 11, 2018 Electronic Signature: Joseph P. Anderson, III/ (Joseph P. Anderson, III)

PTO/SB/08b (07-09)

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				Application Number	16/017,334
				Filing Date	June 25, 2018
				First Named Inventor	Christopher L. Drenth
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				Examiner Name	Not Yet Assigned
				Attorney Docket Number	36362.0150U3
Sheet	2	of	3		

[illegible]

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ⁶
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	G**	WO 2010/094060	08-26-2010	Index Tech Australia Pty		
	H**	WO 2013/040641	03-28-2013	Index Tech Australia Pty		
	I**	WO 2013/126955	09-06-2013	Global Tech Corp Pty Ltd.		
	J	WO 2014/053512	04-10-2014	ImmioVare Pty Ltd		
	K**	WO 2014/080618	06-10-2014	2iG Australia Pty Ltd.		
	L	WO 2015/164394	10-29-2015	Longyear Tm, Inc.		

Examiner Signature		Date Considered	
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EXAMINER: Initial if reference considered whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08b (07-09)

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Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Application Number	16/017,334
				Filing Date	June 25, 2018
				First Named Inventor	Christopher L. Drenth
				Art Unit	3676
				Examiner Name	Not Yet Assigned
Sheet	3	of	3	Attorney Docket Number	36362.0150U3

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	A**	International Search Report and Written Opinion were mailed on 7/24/2015 by the International Searching Authority for International Application No. PCT/US2015/026907, filed on 4/21/2015 and published as WO 2015/164394 on 10/29/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket- 36362.0150P1) (11 Pages)	
	B	International Preliminary Report on Patentability was mailed on 10/25/2016 by the International Searching Authority for International Application No. PCT/US2015/026907, filed on 4/21/2015 and published as WO 2015/164394 on 10/29/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket- 36362.0150P1) (9 Pages)	
	C**	Third Party Observations dated August 17, 2016 for International Patent Application No. PCT/US2015/026907 (Applicant- Longyear TM, Inc.) (42 pages)	
	D	Examination Report was issued on 8/14/2018 by the Australian Patent Office for AU Application No. 2015249889, which was filed on 4/21/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150AU1) (3 pages)	
	E	Office Action was issued on 7/11/2018 by the Chilean Patent Office for CL Application No. 2016-002684, which was filed on 4/21/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150CL1) (3 pages)	
	F**	Extended European Search Report issued on 10/17/2017 by the European Patent Office for Application No. 15782230.5, which was filed on April 21, 2015 and published as EP 3134600 on March 1, 2017 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150EP1) (9 pages)	
	G	Preliminary Amendment was mailed on 2/28/2017 to the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (7 pages)	
	H	Non Final Rejection was issued on 8/18/2017 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (7 pages)	
	I	Response to Non Final Rejection was mailed on 10/18/2017 to the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (9 pages)	
	J	Notice of Allowance was issued on 11/8/2017 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (5 pages)	
	K	Notice of Allowance was issued on 4/12/2018 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (7 pages)	
	L	Issue Notification was issued on 7/25/2018 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (1 page)	
Examiner Signature	/MICHAEL R WILLS III/		Date Considered 03/08/2019

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹Applicant's unique citation designation number (optional). ²Applicant is to place a check mark here if English language Translation is attached.

Bibliographic Data

Application No: 16/017,334

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged: /MICHAEL R WILLS III/

Examiner's Signature

Initials

Title:

Core Barrel Head Assembly With An Integrated Sample Orientation
Tool And System For Using Same

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
06/25/2018	175	3676	36362.0150U3
RULE			

APPLICANTS

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CONTINUING DATA

This application is a CON of 14692484 04/21/2015 PAT 10047581
14692484 has PRO of 61982052 04/21/2014

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

07/12/2018

STATE OR COUNTRY

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ATLANTA, GA 30309-3915
UNITED STATES

FILING FEE RECEIVED

\$1,820

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3	"14692484"	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 09:35
L2	296	((("DRENTH") near3 ("CHRISTOPHER")) OR (("STEWART") near3 ("GORDON")) OR (("HEJLEH") near3 ("KHALED"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2019/03/01 09:36
L3	213	(E21B25/16).cpc.	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 09:38
L4	0	WO "20133126955"	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 10:15
L5	6	(US-20150300162-\$ or US-20150136488-\$ or US-20150029035-\$).did. or (US-6006844-\$ or US-4955438-\$ or US-7296638-\$).did.	US-PGPUB; USPAT	ADJ	ON	2019/03/01 10:17
L6	3	L5 and window	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 10:17
L7	21	(US-0145461-\$ US-0300162-\$ US-10047581-\$ US-15782230-\$ US-1626126-\$ US-2944792-\$ US-2134921-\$ US-2243173-\$ US-3134600-\$ US-4955438-\$ US-5601152-\$ US-6732818-\$ US-7296638-\$ US-20120145461-\$ US-20150300162-\$).DID.	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:09
L8	39	("1773915" "2652232" "3115196" "5957221").PN. OR ("7296638").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:17
L9	20	("3049185" "3194326" "3333647" "4279315" "4558749").PN. OR ("5601152").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:17
L10	34	("1752388" "1867024" "1870696" "20010013429" "20040065482" "20050025594" "20090317202" "20100054884" "20120241223" "2484365" "2689109" "2708103" "3140749" "3517754" "4848454" "4951761" "5161859" "5601152" "6698981" "6799648" "7281594"	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:17

		"7296641" "8763282" "8960336" "9162371").PN. OR ("D826299").URPN.				
L11	39	("1773915" "2652232" "3115196" "5957221").PN. OR ("7296638").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:18
L12	7	("20120145461" "2944792" "4955438" "5601152" "6732818" "7296638").PN. OR ("10047581").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:18
L13	0	(L5 or L7) and pressure fitting	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:22
L14	2	(L5 or L7) and pressure fitting	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:22
L15	4	(L5 or L7) and fitting	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:24
L16	2	(L5 or L7) and port same check valve	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:24
L17	11	(L3) and port same check valve	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:33
L18	3	L3 and pressure fitting	US-PGPUB; USPAT; USOCR	ADJ	ON	2019/03/01 11:33
S1	1	"14692484"	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/06/16 07:57
S2	79	((("DRENTH") near3 ("CHRISTOPHER"))).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 12:08
S3	145	((("STEWART") near3 ("GORDON"))).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 12:21
S4	47	((("STEWART") near3 ("GORDON"))).INV.	EPO; JPO; DERWENT	ADJ	ON	2017/08/10 12:21
S5	7	((("HEJLEH") near3 ("KHALED"))).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 14:08
S6	2	("20120145461" "6732818").PN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 15:04
S7	201	(E21B25/16).cpc.	US-PGPUB;	ADJ	ON	2017/08/10 15:07

			USPAT; USOCR			
S8	440855	(power source or battery) and (body or housing)and (instrument or sensor)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/10 16:21
S9	0	WO "2008113127"	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 10:41
S10	3	"2008113127"	US- PGPUB; USPAT; USOCR; DERWENT	ADJ	ON	2017/08/11 10:41
S11	201	(E21B25/16).cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:12
S12	48	S11 and (battery or power source)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:12
S13	3	(US-20150300162-\$ or US-20150136488-\$ or US-20150029035-\$).did.	US- PGPUB	ADJ	ON	2017/08/11 11:15
S14	3	S13 and (battery or power source)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:15
S15	3	S13 and (battery or power source or power supply)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:19
S16	48	S11 and (battery or power source or power supply)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:19
S17	21	S11 and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:45
S18	0	702/2.cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:46
S19	921	702/2.ccls.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:46
S20	236	S19 and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:46
S21	8	S19 and window and core\$3 and orientat\$3	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:47
S22	606	E21B\$.cpc.and window and core\$3 and	US-	ADJ	ON	2017/08/11

		orientat\$3 and (battery or power source or power supply)	PGPUB; USPAT; USOCR			11:48
S23	606	E21B\$.cpc. and window and core\$3 and orientat\$3 and (battery or power source or power supply)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:48
S24	263	E21B\$.cpc. and window and core\$3 and orientat\$3 and (battery or power source or power supply) and wireline	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:54
S25	300	E21B\$.cpc. and window and core\$3 and orientat\$3 and (battery or power source or power supply) and (wireline or wire line)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 11:54
S26	346	E21B\$.cpc. and window and cor\$3 and orientat\$3 and (battery or power source or power supply) and (wireline or wire line)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 12:07
S27	1730	window and cor\$3 and orientat\$3 and (battery or power source or power supply) and (wireline or wire line)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 12:08
S28	114	S27 AND ((E21B17/028 OR E21B47/09 OR E21B25/16).CPC.)	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/11 12:20
S29	2	("20120145461" "6732818").PN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:07
S30	0	("2012/0145461").URPN.	USPAT	ADJ	ON	2017/08/12 14:07
S31	20	("1701724" "1773915" "2120240" "2489566" "2974739" "3059707" "3148740" "3207239" "4128134" "4558749" "4883131").PN. OR ("6732818").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:07
S32	28	("20040036474" "3618221" "3875796" "4128134" "4311201" "4389792" "4765414" "4883131" "5048619" "5052502" "5105894" "5310013" "6006844" "6082453" "6412575" "6592875" "6659196" "6732818" "6871410" "7296638").PN. OR ("7584055").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:07
S33	38	("1773915" "2652232" "3115196" "5957221").PN. OR ("7296638").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:08
S34	846	E21B25/00.cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:09
S35	9	S34 and window and core\$3 and orientat\$3	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:09
S36	69	S34 and core\$3 and orientat\$3	US-	ADJ	ON	2017/08/12

			PGPUB; USPAT; USOCR			14:09
S37	38	("1773915" "2652232" "3115196" "5957221").PN. OR ("7296638").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:10
S38	101	("2489566" "2735652" "2820610" "3059707" "3127943" "3481412" "3548958" "4601354" "4765414" "4815342" "4955438" "4981183" "4982802" "5009273" "5010765" "5010789" "5020612" "5029653" "5038873" "5042596" "5090492" "5099934" "5103921" "5109935" "5111892" "5119892" "5131478" "5165494" "5178222" "5253720" "5322135" "5339915" "5351765" "5448227" "5568838").PN. OR ("6006844").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:11
S39	40	("2820610" "3059707" "3346059" "4515225" "4562560" "4715022" "4765414").PN. OR ("4955438").URPN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/08/12 14:11
S40	0	("2015/0300162").URPN.	USPAT	ADJ	ON	2017/08/12 14:11
S41	0	("2015/0136488").URPN.	USPAT	ADJ	ON	2017/08/12 14:11
S42	0	("2015/0029035").URPN.	USPAT	ADJ	ON	2017/08/12 14:11
S43	1	"14962484"	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:20
S44	12	"5601152"	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:22
S45	1	"14692484"	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:30
S46	203	(E21B25/16).cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:35
S47	0	core barrel and cavity and electronic intrument and sensor and power source and core and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:37
S48	1	core barrel and cavity and electronic instrument and sensor and power source and core and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:37
S49	1	core barrel and cavity and orientation and sensor and power source and core and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:38
S50	4551	cavity and orientation and sensor and	US-	ADJ	ON	2017/10/30

		power source and core and window	PGPUB; USPAT; USOCR			11:38
S51	141	electronic instrument and cavity and orientation and sensor and power source and core and window	US- PGPUB; USPAT; USOCR	ADJ	ON	2017/10/30 11:39
S56	2	("2944792").PN.	US- PGPUB; USPAT; USOCR	ADJ	ON	2018/02/17 15:54
S57	204	(E21B25/16).cpc.	US- PGPUB; USPAT; USOCR	ADJ	ON	2018/02/17 15:57

3/ 1/ 2019 11:33:45 AM
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/017,334	06/25/2018	CHRISTOPHER L. DRENTH	36362.0150U3

CONFIRMATION NO. 6991

POA ACCEPTANCE LETTER



OC000000103946527

23859
Ballard Spahr LLP
SUITE 1000
999 PEACHTREE STREET
ATLANTA, GA 30309-3915

Date Mailed: 11/21/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 11/16/2018.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/dtdinh/

Electronic Acknowledgement Receipt

EFS ID:	34329700
Application Number:	16017334
International Application Number:	
Confirmation Number:	6991
Title of Invention:	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH
Customer Number:	23859
Filer:	Joseph P. Anderson
Filer Authorized By:	
Attorney Docket Number:	36362.0150U3
Receipt Date:	16-NOV-2018
Filing Date:	25-JUN-2018
Time Stamp:	14:54:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	36362_0150U3_POA_Globaltech.h.PDF	528967 9872f75c4d43f70c600c5cf13633a28147eb397e	no	4

Warnings:

Information:	
Total Files Size (in bytes):	528967
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.	

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/017,334
Filing Date	June 25, 2018
First Named Inventor	Drenth, Christopher L.
Title	Core Barrel Assembly With An Integrated Sample Orientation Tool and System For Using Same
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	36362.0150U3

SIGNATURE of Applicant or Patent Practitioner

Signature	/Joseph P. Anderson, III/	Date (Optional)	
Name	Joseph P. Anderson, III	Registration Number	59245
Title (if Applicant is a juristic entity)	Patent Practitioner		
Applicant Name (if Applicant is a juristic entity)	Globaltech Corporation PTY LTD		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.



*Total of 2 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☐

Practitioners associated with Customer Number:

23859

OR

☒

Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

☒

The address associated with Customer Number:

OR

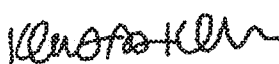
☐	Firm or Individual Name			
	Address			
	City	State	Zip	
	Country			
	Telephone	Email		

Assignee Name and Address: GLOBALTECH CORPORATION PTY LTD
ABN 18 087 281 418 of 1/48
Vinnicombe Drive
Canning Vale, Australia 6155

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date
Name	Digitally signed by Khaled Hejleh Date: 2015.09.10 10:42:35 +08'00'	Telephone
Title	Managing Director	

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: GLOBALTECH CORPORATION PTY LTDApplication No./Patent No.: 16/017,334 Filed/Issue Date: June 25, 2018Titled: Core Barrel Assembly With An Integrated Sample Orientation Tool And System For Using SameGLOBALTECH CORPORATION PTY LTD, a Corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☐ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☒ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

LONGYEAR TM, INC.

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 047381, Frame 0878, or for which a copy thereof is attached.
- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:
1. From: _____ To: _____
- The document was recorded in the United States Patent and Trademark Office at
- Reel _____, Frame _____, or for which a copy thereof is attached.
2. From: _____ To: _____
- The document was recorded in the United States Patent and Trademark Office at
- Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

REFLEX EXHIBIT 1011 - 78/225

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
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5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Joseph P. Anderson, III/

Signature

Joseph P. Anderson, III

Printed or Typed Name

November 16, 2018

Date

59,245

Title or Registration Number

Electronic Acknowledgement Receipt

EFS ID:	34329678
Application Number:	16017334
International Application Number:	
Confirmation Number:	6991
Title of Invention:	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH
Customer Number:	23859
Filer:	Joseph P. Anderson
Filer Authorized By:	
Attorney Docket Number:	36362.0150U3
Receipt Date:	16-NOV-2018
Filing Date:	25-JUN-2018
Time Stamp:	14:53:13
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	36362_0150U3_POA_Longyear .PDF	333997 bb889122233a1a0ae42402932fd3478b2fb 6fedd	no	4

Warnings:

Information:	
Total Files Size (in bytes):	333997
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.	

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/017,334
Filing Date	June 25, 2018
First Named Inventor	Drenth, Christopher L.
Title	Core Barrel Assembly With An Integrated Sample Orientation Tool and System For Using Same
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	36362.0150U3

SIGNATURE of Applicant or Patent Practitioner

Signature	/Joseph P. Anderson, III/	Date (Optional)	
Name	Joseph P. Anderson, III	Registration Number	59245
Title (if Applicant is a juristic entity)	Patent Practitioner		
Applicant Name (if Applicant is a juristic entity)	Longyear TM, Inc.		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.



*Total of 2 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:



Practitioners associated with Customer Number:

23859

OR



Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:



The address associated with Customer Number:

23859

OR

☐	Firm or Individual Name			
	Address			
	City	State	Zip	
	Country			
	Telephone	Email		

Assignee Name and Address: LONGYEAR TM, INC.
2640 W 1700 S
Salt Lake City, Utah 84104

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	Feb. 11, 2016
Name	Fabrizio Rasetti	Telephone	
Title	President		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO in process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: LONGYEAR TM, INC.Application No./Patent No.: 16/017,334 Filed/Issue Date: June 25, 2018Titled: Core Barrel Assembly With An Integrated Sample Orientation Tool And System For Using SameLONGYEAR TM, INC., a Corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☐ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☒ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

GLOBALTECH CORPORATION PTY LTD

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 047381, Frame 0878, or for which a copy thereof is attached.
- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:
1. From: _____ To: _____
- The document was recorded in the United States Patent and Trademark Office at
- Reel _____, Frame _____, or for which a copy thereof is attached.
2. From: _____ To: _____
- The document was recorded in the United States Patent and Trademark Office at
- Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Joseph P. Anderson, III/

Signature

Joseph P. Anderson, III

Printed or Typed Name

November 16, 2018

Date

59,245

Title or Registration Number



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/017,334	06/25/2018	CHRISTOPHER L. DRENTH	36362.0150U3

CONFIRMATION NO. 6991

PUBLICATION NOTICE



OC000000103351104

23859
Ballard Spahr LLP
SUITE 1000
999 PEACHTREE STREET
ATLANTA, GA 30309-3915

Title:Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same

Publication No.US-2018-0305995-A1

Publication Date:10/25/2018

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/017,334
				Filing Date	June 25, 2018
				First Named Inventor	Christopher L. Drenth
				Art Unit	3676
				Examiner Name	Not Yet Assigned
				Attorney Docket Number	36362.0150U3

[illegible]

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ²
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	A**	EP 2134921	12-23-2009	2iC Australia Pty Ltd.		
	B**	GB 2243173	10-23-1991	Seafloors Eng Inc		
	C**	WO 2006/024111	03-09-2006	Australia Mud Co Ltd.		
	D**	WO 2007/104103	09-20-2007	2iC Australia Pty Ltd.		
	E**	WO 2007/137356	12-06-2007	2iC Australia Pty Ltd.		
	F**	WO 2008/113127	09-252008	2iC Australia Pty Ltd.		

Examiner Signature		Date Considered	
-----------------------	--	--------------------	--

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 809. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with 37 CFR § 1.6(a)(4).

Dated: October 11, 2018

Electronic Signature: Joseph P. Anderson, III (Joseph P. Anderson, III)

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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/017,334
				Filing Date	June 25, 2018
				First Named Inventor	Christopher L. Drenth
				Art Unit	3676
				Examiner Name	Not Yet Assigned
Sheet	2	of	3	Attorney Docket Number	36362.0150U3

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ⁵
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	G**	WO 2010/094060	08-26-2010	Imdex Tech Australia Pty		
	H**	WO 2013/040641	03-28-2013	Imdex Tech Australia Pty		
	I**	WO 2013/126955	09-06-2013	Global Tech Corp Pty Ltd.		
	J**	WO 2014/053012	04-10-2014	Minnovare Pty Ltd		
	K**	WO 2014/089618	06-19-2014	2iC Australia Pty Ltd.		
	L	WO 2015/164394	10-29-2015	Longyear Tm, Inc.		

Examiner Signature		Date Considered	
-----------------------	--	--------------------	--

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible.

⁶ Applicant is to place a check mark here if English language Translation is attached.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Application Number	16/017,334
				Filing Date	June 25, 2018
				First Named Inventor	Christopher L. Drenth
				Art Unit	3676
				Examiner Name	Not Yet Assigned
Sheet	3	of	3	Attorney Docket Number	36362.0150U3

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	A**	International Search Report and Written Opinion were mailed on 7/24/2015 by the International Searching Authority for International Application No. PCT/US2015/026907, filed on 4/21/2015 and published as WO 2015/164394 on 10/29/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket- 36362.0150P1) (11 Pages)	
	B	International Preliminary Report on Patentability was mailed on 10/25/2016 by the International Searching Authority for International Application No. PCT/US2015/026907, filed on 4/21/2015 and published as WO 2015/164394 on 10/29/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket- 36362.0150P1) (9 Pages)	
	C**	Third Party Observations dated August 17, 2016 for International Patent Application No. PCT/US2015/026907 (Applicant- Longyear TM, Inc.) (42 pages)	
	D	Examination Report was issued on 8/14/2018 by the Australian Patent Office for AU Application No. 2015249889, which was filed on 4/21/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150AU1) (3 pages)	
	E	Office Action was issued on 7/11/2018 by the Chilean Patent Office for CL Application No. 2016-002684, which was filed on 4/21/2015 (Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150CL1) (3 pages)	
	F**	Extended European Search Report issued on 10/17/2017 by the European Patent Office for Application No. 15782230.5, which was filed on April 21, 2015 and published as EP 3134600 on March 1, 2017 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150EP1) (9 pages)	
	G	Preliminary Amendment was mailed on 2/28/2017 to the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (7 pages)	
	H	Non Final Rejection was issued on 8/18/2017 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (7 pages)	
	I	Response to Non Final Rejection was mailed on 10/18/2017 to the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (9 pages)	
	J	Notice of Allowance was issued on 11/8/2017 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (5 pages)	
	K	Notice of Allowance was issued on 4/12/2018 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (7 pages)	
	L	Issue Notification was issued on 7/25/2018 by the USPTO for U.S. Application No. 14/692,484, which was filed on April 21, 2015 and granted as 10,047,581 on 8/14/2018 (Inventor- Drenth et al.; Applicant- Longyear TM, Inc.) (Attorney Docket No.- 36362.0150U2) (1 page)	
Examiner Signature			Date Considered

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 809. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹Applicant's unique citation designation number (optional). ²Applicant is to place a check mark here if English language Translation is attached.

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with 37 CFR § 1.6(a)(4).

Dated: October 11, 2018

Electronic Signature for Joseph P. Anderson, III /Joseph P. Anderson, III/

ATTORNEY DOCKET NO. 36362.0150U3

VIA EFS-WEB

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	)	
	)	
CHRISTOPHER L. DRENTH, ET AL.	)	Art Unit: 3676
	)	
Application No.: 16/017,334	)	Examiner: <i>Not Yet Assigned</i>
	)	
Filing Date: June 25, 2018	)	Confirmation No.: 6991
	)	
For: CORE BARREL HEAD ASSEMBLY WITH AN	)	
INTEGRATED SAMPLE ORIENTATION TOOL AND	)	
SYSTEM FOR USING SAME	)	

INFORMATION DISCLOSURE STATEMENT

MAIL STOP
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

BALLARD SPAHR LLP
Customer No. 23859

October 11, 2018

Commissioner:

Pursuant to the requirements set forth in 37 C.F.R. § 1.56, Applicant now submit a list of documents known to Applicant or Applicant's attorneys. Pursuant to 37 C.F.R. § 1.98(a)(2)(iv), and for the Examiner's review, Applicant has enclosed (1) copies of documents from the prosecution of related U.S. and non-U.S. patent applications, and (2) copies of non-U.S. patents or non-U.S. patent application publications. In accordance with 37 C.F.R. § 1.98(a)(2), copies of any cited U.S. patent or U.S. patent application publication documents are not enclosed.

Applicant has enclosed an English language abstract of any non-U.S. Patent or Patent Application which is written in a foreign language.

In accordance with 37 C.F.R. § 1.98(d), those documents which are marked with a double asterisk (**) next to the Cite No. in the attached form PTO/SB/08 are not supplied because they were previously cited by or submitted to the Office in prior application numbers 61/982,052 filed April 21, 2014, and 14/692484, filed April 21, 2015 and relied upon in this application for an earlier filing date under 35 U.S.C. § 120.

Regarding the documents from the prosecution of related U.S. and non-U.S. patent applications, Applicant has identified the prosecution record of U.S. and non-U.S. patent applications as the source for

ATTORNEY DOCKET NO. 36362.0150U3
APPLICATION NO. 16/017,334

each document. The information provided mirrors the requirements for cited U.S. and non-U.S. patent applications as set forth by 37 C.F.R. § 1.98(b).

Applicant respectfully requests consideration of all documents submitted in the present Information Disclosure Statement and List and entry into the record for the present application (Application No. 16/017,334).

Applicant would like to bring to the Examiner's attention the existence of the following U.S. patent applications.

INFORMATION DISCLOSURE STATEMENT for Application No. 16/017,334 (Attorney Docket No. 36362.0150U3) Disclosure of U.S. Patent Applications				
Examiner's Initials	App. No. (Pub./Patent No.)	Filing Date (Pub./Issue Date)	1st Named Inventor (Applicant)	Attorney Docket No.
	61/982052	04/21/2014	Christopher L. Drenth	36362.0150U1-
	14/692484 (10,047,581)	04/21/2015 (8/14/2018)	Christopher L. Drenth	36362.0150U2-

Applicants would like to bring to the Examiner's attention the existence of the following non-U.S. patent applications.

INFORMATION DISCLOSURE STATEMENT for Application No. 16/017,334 (Attorney Docket No. 36362.0150U3) Disclosure of Non-U.S. Patent Applications					
Examiner's Initials	Country	Application No. (Publication No.)	Filing Date	1st Named Inventor (Applicant)	Attorney Docket No.
	AU	2015249889	04/21/2015	Longyear TM, Inc.	36362.0150AU1
	BR	BR112016024554.7	04/21/2015	Longyear TM, Inc.	36362.0150BR1
	CA	2946574	04/21/2015	Longyear TM, Inc.	36362.0150CA1
	CL	2016-002684	04/21/2015	Longyear TM, Inc.	36362.0150CL1
	CN	2015800211077	04/21/2015	Longyear TM, Inc.	36362.0150CN1
	EP	15782230.5	04/21/2015	Longyear TM, Inc.	36362.0150EP1
	PCT	PCT/US2015/026907 (WO2015/164394)	04/21/2015 (10/29/2015)	Longyear TM, Inc.	36362.0150P1-

INFORMATION DISCLOSURE STATEMENT for Application No. 16/017,334 (Attorney Docket No. 36362.0150U3) Disclosure of Non-U.S. Patent Applications					
Examiner's Initials	Country	Application No. (Publication No.)	Filing Date	1st Named Inventor (Applicant)	Attorney Docket No.
	PE	2111-2016	04/21/2015	Longyear TM, Inc.	36362.0150PE1
	ZA	2016/07259	04/21/2015	Longyear TM, Inc.	36362.0150ZA1

Pursuant to 37 C.F.R. § 1.97(b)(3), Applicant submits that this document is timely filed in that the Patent and Trademark Office has not yet mailed to Applicant a first Office Action on the merits. Applicant submits that no fee is due; however, Applicant hereby authorizes the Commissioner to charge to Deposit Account No. 14-0629 any fee that may be required to effect the consideration and entry of this Information Disclosure Statement and List and the references contained therein.

Respectfully submitted,

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Electronic Acknowledgement Receipt

EFS ID:	33979965
Application Number:	16017334
International Application Number:	
Confirmation Number:	6991
Title of Invention:	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH
Customer Number:	23859
Filer:	Joseph P. Anderson
Filer Authorized By:	
Attorney Docket Number:	36362.0150U3
Receipt Date:	11-OCT-2018
Filing Date:	25-JUN-2018
Time Stamp:	14:29:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Foreign Reference	WO2015164394A1.pdf	2414231	no	49
			a9615ac9b2565f029a6110bd5d46ce146053c211		

Warnings:

Information:					
2	Non Patent Literature	36362_0150P1_IPRP.pdf	342255	no	9
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Warnings:					
Information:					
3	Non Patent Literature	36362_0150AU1_ExaminationReport_8_14_2018.pdf	166605	no	3
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Warnings:					
Information:					
4	Non Patent Literature	36362_0150CL1_OA_7_11_2018.pdf	367292	no	11
			e65e30cea95eebf26039cf7d3cc80168c53f9f41		
Warnings:					
Information:					
5	Non Patent Literature	36362_0150U2_PreliminaryAmendment_2_28_2017.pdf	281426	no	7
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Warnings:					
Information:					
6	Non Patent Literature	36362_0150U2_NonFinal_8_18_2017.pdf	285005	no	7
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Warnings:					
Information:					
7	Non Patent Literature	36362_0150U2_ResponseNonFinal_10_18_2017.pdf	358248	no	9
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Warnings:					
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8	Non Patent Literature	36362_0150U2_NOA_11_8_2017.pdf	266068	no	5
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9	Non Patent Literature	36362_0150U2_NOA_4_12_2018.pdf	387271 6174a9e7226d2a2a0e63a45ed163ac6c76d94668	no	7
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10	Non Patent Literature	36362_0150U2_IssueNotification_7_25_2018.pdf	54884 0677e6c178521d1cf7d2475184a95e723c41259b	no	1
Warnings:					
Information:					
11	Information Disclosure Statement (IDS) Form (SB08)	36362_0150U3_IDS_SB08_10_11_2018.pdf	241796 c15445533a2948f125ae442262a50694fe989f55	no	3
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Information:					
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12	Transmittal Letter	36362_0150U3_IDS_Transmittal_10_11_2018.pdf	196741 23248e7bb2686e1cac98bee71c75ecb4cb7ef61a	no	3
Warnings:					
Information:					
Total Files Size (in bytes):			5361822		
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- (51) **International Patent Classification:**
E21B 10/02 (2006.01) *E21B 49/02* (2006.01)
- (21) **International Application Number:**
PCT/US2015/026907
- (22) **International Filing Date:**
21 April 2015 (21.04.2015)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/982,052 21 April 2014 (21.04.2014) US
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- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

- *with international search report (Art. 21(3))*

(54) **Title:** CORE BARREL HEAD ASSEMBLY WITH AN INTEGRATED SAMPLE ORIENTATION TOOL AND SYSTEM FOR USING SAME

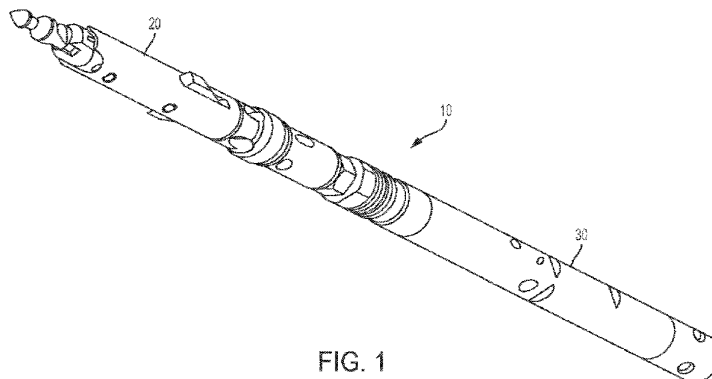


FIG. 1

(57) **Abstract:** A core barrel head assembly having at least one electronic instrument that is configured to obtain orientation data; a power source; and a communication means to receive and/or transmit orientation data for use in a core sample down hole surveying and sample orientation system that is configured to provide an indication of the orientation of a core sample relative to a body of material from which the core has been extracted, and also to a method of core sample orientation identification.

**CORE BARREL HEAD ASSEMBLY WITH AN INTEGRATED SAMPLE
ORIENTATION TOOL AND SYSTEM FOR USING SAME**

CROSS REFERENCE TO RELATED PATENT APPLICATION

[0001] This application claims priority to U.S. Provisional Application No. 61/982,052 filed April 21, 2014, which is herein incorporated by reference in their entirety.

FIELD OF THE INVENTION

[0002] The present invention relates to down hole surveying in drilling operations. More particularly, to a core barrel assembly having at least one electronic instrument that is configured for use in a core sample down hole surveying and sample orientation system. In one example, the at least one electronic instrument is configured to provide an indication of the orientation of a core sample relative to a body of material from which the core has been extracted, and also to a method of core sample orientation identification.

BACKGROUND

[0003] Conventionally, core samples are obtained through the use of core drilling systems that comprise outer and inner tube assemblies. In operation, a cutting head is attached to the outer tube assembly so that rotational torque applied to the outer tube assembly can be transmitted to the cutting head. A core is generated during the drilling operation, with the core progressively extending along the elongate axis of the inner tube assembly as drilling progresses. Typically, when a core sample is acquired, the core within the inner tube assembly is fractured and the inner tube assembly and the fractured core sample contained therein are then retrieved from within the drill hole, typically by way of a retrieval cable lowered down the drill hole. Once the inner tube assembly has been brought to ground surface, the core sample can be removed and subjected to the desired analysis.

[0004] It is desirable for analysis purposes to have an indication of the orientation of the core sample relative to the ground from which it was extracted. This is complicated in that it is common to drill at an angle relative to the vertical. For efficiency and accuracy of the mineralogical record, it is desirable to determine the orientation and survey position of each core's position underground before being drilled out and extracted. Such orientation and survey positions allow for the

subsequent production of a three dimensional map of underground mineral/rock content.

[0005] One common way of obtaining an indication of the orientation of a core sample is through use of an orientation spear comprising a marker (such as a crayon) projecting from one end of a thin steel shank, the other end of which is attached to a wire line. The orientation spear is lowered down the drill hole, prior to the inner tube assembly being introduced. The marker on the orientation spear strikes the facing surface of material from which the core is to be generated, leaving a mark thereon. Because of gravity, the mark is on the lower side of the drill hole. The inner tube assembly is then introduced into the outer tube assembly in the drill hole. As drilling proceeds, a core sample is generated within the inner tube assembly. The core sample so generated carries the mark which was previously applied. Upon completion of the core drilling run and retrieval of the core sample, the mark provides an indication of the orientation of the core sample at the time it was in the ground.

[0006] Other conventional technologies use core orientation units attached to core inner tubes and back-end assemblies to determine the correct orientation of the drilled out core sample after a preferred predetermined drilling distance intervals during drilling. These core orientation units typically measure rotational direction of the core sample before extraction. On retrieval at the surface of the hole, the rotational direction can be determined by electronic means and the upper or lower side of the core material physically 'marked' for later identification by geologists.

[0007] Coupled with the core orientation system, a survey instrument is conventionally used. In this technique, at periodic depths, the survey instrument is lowered down the drill hole to determine azimuth (angular measurement relative to a reference point or direction), dip (or inclination) and any other required survey parameters. These periodic depth survey readings are used to approximate the drill-path at different depths. Together with the rotational position of the extracted core (from the core orientation device), the three dimensional subsurface material content map can be determined.

[0008] It has been found desirable to provide an improved core barrel assembly having an integrated sample orientation subassembly and method for using same that is configured for use in a core sample down hole surveying and sample

orientation that minimizes the need to add additional drill string elements, which allows for increased efficiency and speed of drilling.

SUMMARY

[0009] In one aspect, the present invention provides a core barrel head assembly having an elongate tube body that defines a selectively sealed interior cavity. The core barrel head assembly can have at least one electronic instrument positioned in the interior cavity that is configured to obtain core orientation data of a core sample and a power source positioned in the interior cavity and in electrical communication with the at least one electronic instrument. The core barrel head assembly can also have a communication means that is configured to receive and/or transmit orientation data for use in a core sample down hole surveying and/or sample orientation system. The derived core orientation data provides an indication of the orientation of the core sample relative to a body of material from which the core has been extracted, and also to a method of using same.

[0010] The core barrel head assembly is configured for connection to tube portions of a drill string via respective connection means. In another aspect, the at least one electronic instrument of the core barrel head assembly can be mounted, for example and without limitation, within the interior cavity defined the body, within an interior cavity that is defined therein a side wall of the body of the core barrel head assembly, or potted or in sealed contact with a portion of a side wall of the core barrel assembly (on either an exterior surface or an interior surface of a cavity defined therein the body). As one skilled in the art will contemplate, the core barrel head assembly can comprise at least one electronic instrument that is configured to obtain orientation data, an electrically coupled power source and communication means to receive and/or transmit orientation data.

[0011] In another aspect, the communication means can comprise a wireless communication means that is configured to wirelessly receive and/or transmit survey data. Optionally, the communication means can be configured to communicate one way or two ways with each other, when drilling has ceased or during drilling.

[0012] In one aspect, the at least one electronic instrument of the core barrel head assembly advantageously enables obtaining drill hole survey readings without the need to insert unwieldy extension drill rods and/or a survey probe to measure azimuth and inclination/dip of the drill hole path. This results in a reduction of

equipment handling and usage of equipment, a reduction of operations by not needing to periodically withdraw the drill bit a certain distance in order to advance a survey probe ahead of, and therefore distanced from, the drill bit, with a resultant increase in operational efficiency.

[0013] Another aspect of the present invention provides a method of conducting a down hole survey of drilling, the method including: a) drilling the core from a subsurface body of material; b) recording data relating to orientation of the core to be retrieved, the data recorded using the at least one electronic instrument of the core barrel head assembly, c) separating the core from the subsurface body, and d) obtaining an indication of the orientation of the core based on the recorded core orientation data obtained before the core was separated from the subsurface body.

[0014] Optionally, the method can comprise: determining that drilling has ceased for a period of time, using the at least one electronic instrument of the core barrel head assembly to record data relating to orientation of the core to be retrieved, separating the core from the subsurface body, retrieving the core to the surface, and obtaining an indication of the orientation of the core based on the recorded core orientation data obtained once the drilling had ceased and before the core was separated from the subsurface body.

[0015] Advantages are that there is more time available for drilling due to less time required for surveying and manipulating additional pieces of equipment and mechanical extensions during the survey process.

BRIEF DESCRIPTION OF THE FIGURES

[0016] Figure 1 shows a perspective view of a core barrel head assembly being operatively coupled to a head assembly.

[0017] Figure 2 shows a longitudinal cross-sectional view of Figure 1.

[0018] Figure 3 shows an expanded view of a portion of Figure 2, showing the core barrel head assembly.

[0019] Figure 4 shows a perspective exploded view of the core barrel head assembly of Figure 1.

[0020] Figure 5 shows a longitudinal cross-sectional view of the core barrel head assembly, showing an at least one electronic instrument and an electrically coupled power source disposed therein an interior cavity of a body of the core barrel head assembly.

[0021] Figure 6 shows a longitudinal cross-sectional view of another aspect of the core barrel head assembly, showing an at least one electronic instrument and an electrically coupled power source disposed therein an interior cavity of a body of the core barrel head assembly.

[0022] Figure 7 shows a longitudinal cross-sectional view of the body of the core barrel head assembly.

[0023] Figure 8 shows a longitudinal cross-sectional view of a core barrel head assembly being operatively coupled to a head assembly.

[0024] Figure 9 shows a schematic view of an exemplary at least one electronic instrument.

[0025] Figure 10 shows a schematic view of an exemplary at least one electronic instrument and an electrically coupled power source for disposition therein an interior cavity of a body of the core barrel head assembly.

[0026] Figure 11 shows an exemplary high level flowchart relating to a method of using the present invention.

[0027] Figure 12 shows an exemplary flowchart relating to an alternative embodiment of a method of using the present invention.

[0028] Figure 13 shows an exemplary flowchart relating to an alternative embodiment of a method of using the present invention.

[0029] Figure 14 shows an exemplary prior art hand held device for wirelessly interrogating the core barrel head assembly of the present invention.

DETAILED DESCRIPTION

[0030] The present invention can be understood more readily by reference to the following detailed description, examples, drawings, and claims, and their previous and following description. However, before the present devices, systems, and/or methods are disclosed and described, it is to be understood that this invention is not limited to the specific devices, systems, and/or methods disclosed unless otherwise specified, as such can, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular aspects only and is not intended to be limiting.

[0031] The following description of the invention is provided as an enabling teaching of the invention in its best, currently known embodiment. To this end, those skilled in the relevant art will recognize and appreciate that many changes can be

made to the various aspects of the invention described herein, while still obtaining the beneficial results of the present invention. It will also be apparent that some of the desired benefits of the present invention can be obtained by selecting some of the features of the present invention without utilizing other features. Accordingly, those who work in the art will recognize that many modifications and adaptations to the present invention are possible and can even be desirable in certain circumstances and are a part of the present invention. Thus, the following description is provided as illustrative of the principles of the present invention and not in limitation thereof.

[0032] As used throughout, the singular forms “a,” “an” and “the” include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to “a port” can include two or more such ports unless the context indicates otherwise.

[0033] Ranges can be expressed herein as from “about” one particular value, and/or to “about” another particular value. When such a range is expressed, another aspect includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by use of the antecedent “about,” it will be understood that the particular value forms another aspect. It will be further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint.

[0034] As used herein, the terms “optional” or “optionally” mean that the subsequently described event or circumstance may or may not occur, and that the description includes instances where said event or circumstance occurs and instances where it does not.

[0035] The word “or” as used herein means any one member of a particular list and also includes any combination of members of that list.

[0036] As will be appreciated by one skilled in the art, the methods and systems may take the form of an entirely hardware embodiment, an entirely software embodiment, or an embodiment combining software and hardware aspects. Furthermore, the methods and systems may take the form of a computer program product on a computer-readable storage medium having computer-readable program instructions (e.g., computer software) embodied in the storage medium. More particularly, the present methods and systems may take the form of web-

implemented computer software. Any suitable computer-readable storage medium may be utilized including, without limitation, hard disks, CD-ROMs, optical storage devices, magnetic storage devices, or solid-state electronic storage devices.

[0037] Embodiments of the methods and systems are described below with reference to block diagrams and flowchart illustrations of methods, systems, apparatuses and computer program products. It will be understood that each block of the block diagrams and flowchart illustrations, and combinations of blocks in the block diagrams and flowchart illustrations, respectively, can be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus create a means for implementing the functions specified in the flowchart block or blocks.

[0038] These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including computer-readable instructions for implementing the function specified in the flowchart block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions that execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

[0039] Accordingly, blocks of the block diagrams and flowchart illustrations support combinations of means for performing the specified functions, combinations of steps for performing the specified functions and program instruction means for performing the specified functions. It will also be understood that each block of the block diagrams and flowchart illustrations, and combinations of blocks in the block diagrams and flowchart illustrations, can be implemented by special purpose hardware-based computer systems that perform the specified functions or steps, or combinations of special purpose hardware and computer instructions.

[0040] In one aspect, a drill assembly for drilling into a subsurface body of material can comprise a drill string 10 comprising a drill bit, an outer tube formed of linearly connected tube sections, and an inner tube for receiving the core drilled from the subsurface body. In one aspect, the core barrel head assembly 30 is integrated into the drill string 10 to form a portion of the drill string, such as shown in Figure 1, where the core barrel head assembly is operably coupled to a conventional head assembly 20.

[0041] The core barrel head assembly is configured for connection to tube portions of a drill string via respective connection means. In another aspect, the at least one electronic instrument of the core barrel head assembly can be mounted, for example and without limitation, within the interior cavity defined the body, within an interior cavity that is defined therein a side wall of the body of the core barrel head assembly, or potted or in sealed contact with a portion of a side wall of the core barrel assembly (on either an exterior surface or an interior surface of a cavity defined therein the body). As one skilled in the art will contemplate, the core barrel head assembly can comprise at least one electronic instrument that is configured to obtain orientation data, an electrically coupled power source and communication means to receive and/or transmit orientation data.

[0042] In one aspect, and referring to Figures 1-7, the core barrel head assembly 30 can comprise at least one electronic instrument 40 that is configured to obtain orientation data, a operatively electrically coupled power source 50 and communication means to receive and/or transmit orientation data. In one aspect, at least one electronic instrument 40 can comprise at least one digital and/or electro-mechanical sensors 42, and/or one or more physical data sensors 44 in a core orientation data recording tool that can be configured to determine the core orientation just prior to or after the core break, and, optionally, to detect the signal of the break of the core from the body of material. In various aspects, it is contemplated that the recorded data can optionally include "dip" angle and/or azimuth datum to increase the reliability of the core orientation results as described below.

[0043] In this aspect, the at least one digital and/or electro-mechanical sensor 42 in operative communication with the at least one electronic instrument 40 of the core barrel assembly can be configured to detect vibration and/or to detect tri-axial

gravitation loading acting on the electronic instrument. In one exemplary aspect, once a desired vibration state is detected and/or a desired G-loading state is detected, drilling can cease and the core barrel head assembly can record data relating to the orientation of the core, such as, for example and without limitation, gravitational field strength and direction, and/or magnetic field strength and direction.

[0044] The core barrel head assembly 30 has a proximal end 32 that is operatively oriented toward the drill bit end of the drill string and an opposed distal end 34. As shown in Figures 1 and 5-6, the core barrel head assembly 30 has an elongate tube body 60 that is conventionally joined to a conventional wire line retrieval portion of a head assembly 10. Thus, the head assembly of the drill string is complete without the necessity for the use of an unwieldy extension tube as required in the prior art designs.

[0045] The threaded proximal end 62 of the elongate tube body 60 is in communication with a first interior cavity 64 that extends distally to a base portion 65. Proximate the base portion of the second interior cavity, a port 66 is defined that extends from the exterior surface of the elongate tube body into fluid communication with the first interior cavity. Optionally, in this aspect, it is contemplated that a grease fitting 68 can be mounted in the port 66 to allow for selective passage of grease or lubricant into communication with the first interior cavity and vice versa.

[0046] A second interior cavity 70 is defined therein the elongate tube body 60 that is spaced from and extends distally from the first interior cavity. The second interior cavity 70 can be sized to hermetically enclose at least one of the least one electronic instrument 40 that is configured to obtain orientation data, the power source 50 and the communication means to receive and/or transmit orientation data. In another aspect, the second interior cavity 70 can be sized to hermetically enclose the least one electronic instrument 40 that is configured to obtain orientation data and the power source 50. In one aspect, the at least one electronic instrument 40 can comprise the electronic instrument discussed above and schematically shown in Figures 8 and 9. The at least one electronic instrument 40 is operatively electrically coupled to the power source 50, which can comprise any conventional power source, such as, for example and without limitation, a battery, a rechargeable battery, and the like.

[0047] In one aspect, as shown, a plurality of windows 74 can be defined in the elongate tube body that extend from the exterior surface 61 of the elongate tube body into the second interior chamber 70 proximate the closed proximal end 72 of the second interior chamber. In a further aspect, an orientation indicator module 80 can be provided that comprises a plurality of light emitters 82. The orientation indicator module 80 can be sized and shaped to sealingly close the second interior chamber from any intrusion of pressurized fluid into the second interior chamber 70 via the defined plurality of windows 74.

[0048] In another aspect, it is contemplated that the second interior cavity can comprise at least one orienting slot defined therein. In this aspect, the orientation indicator module can be oriented manually and the desired position can be maintained to the at least one O-ring seal 84 described below. Optionally, in a further aspect, the orientation indicator module 82 is configured to orient or otherwise position a plurality of light emitters 88 so that each light emitter underlies one window.

[0049] In one aspect, the orientation indicator module 80 can further comprise a sealing means for preventing any pressurized fluid from entering the second interior cavity 70 from the defined windows 74. In one aspect, the sealing means can comprise at least one O-ring seal 84 that is mounted on an exterior portion of the orientation indicator module and that is configured to seal between the exterior portion of the orientation indicator module and a portion of the interior surface of the second interior cavity.

[0050] In one exemplary aspect, light from the plurality of light emitters 88 (e.g. LEDs, and the like) passes through or can be observed through the plurality of windows 74. Reference arrow A refers to the drill bit end direction, and reference arrow B refers to the head assembly direction. Further, as described above, the process of obtaining core orientation is made easier by only requiring two color lights, such as, for example and without limitation, green and red, to indicate one or other direction of rotation to establish correct core orientation prior to marking. The indicators form part of the sealed device and can be low power consumption LED lights.

[0051] Alternatively, flashing lights may be used, such as, for example and without limitation, a certain frequency or number of flashes for one direction and

another frequency or number of flashes for the other direction of rotation. A steady light could be given when correct orientation is achieved. Thus, advantageously, when the core barrel head assembly 30 and the core sample are recovered from down the hole, the core barrel head assembly 30 need not be separated from the drill string in order to determine a required orientation of the core sample. Wireless communication to a remote device, such as a hand held device, to transfer data between the core barrel head assembly and the remote device, can also be effected by transmitting through the at least one aperture.

[0052] In another aspect, the second interior cavity 70 extends distally to the open distal end 73 of the elongate tube body 60. To further effect a hermetical enclosure of the least one electronic instrument 40 that is configured to obtain orientation data, the power source 50 and, optionally, the communication means to receive and/or transmit orientation data, a seal coupler 90 can be provided that is configured to be sealingly received in the open threaded distal end 73 of the elongate tube body 60. As noted, a sealing means can be provided to prevent any pressurized fluid from entering the second interior cavity. In one aspect, the sealing means can comprise at least one O-ring seal 95 that is mounted on a portion of the seal coupler and that is configured to seal between a portion of the seal coupler and a portion of the interior surface of the open distal end of the elongate tube body.

[0053] In a further aspect, to further effect a hermetical seal of the second interior cavity and to provide fluid control for the wire line operation, a check valve assembly 100 is provided. In one aspect, the check valve assembly 100 comprises a coupled proximal end assembly and a distally tapered seat that defines an interior chamber 110 for operative receipt of a check ball 120.

[0054] In one aspect, the proximal end assembly 102 of the check valve assembly can define a female threaded coupling that is configured to be threadably coupled to the male threads defined on the exterior surface of the distal end 73 of the elongate tube body 60. As one skilled in the art will appreciate, as the proximal end assembly of the check valve assembly 100 is threadably coupled to the distal end 73 of the elongate tube body, the seal coupler 90 is driven into a sealed position therein the second interior cavity 70 to affect complete hermeticity.

[0055] Further, as one skilled in the art will appreciate, because the orientation indicator module 90 is sealingly disposed in the proximal end of the second interior chamber 70, the least one electronic instrument 40, the power source 50 and, optionally, the communication means to receive and/or transmit orientation data is disposed in operative contact with the orientation indicator module, and the seal coupler 90 is disposed in contact with the least one electronic instrument 40, the power source 50 and, optionally, the communication means to receive and/or transmit orientation data, as the proximal end assembly of the check valve assembly is threadably coupled to the distal 73 end of the elongate tube body, both the sealing means on the respective orientation indicator module 80 and the seal coupler 90 are driven into a sealed position therein the second interior cavity to affect complete hermeticity of the second interior cavity.

[0056] In another aspect, the interior chamber 110 of the check valve assembly extends to a distal end 104 of the check valve assembly. In this aspect, at least one port 106 is provided that extends from the exterior surface of the check valve assembly and is in fluid communication with the interior chamber of the check valve assembly. In one aspect, the at least one port 106 can comprise a plurality of ports. In this aspect, it is contemplated that the plurality of ports can be angularly spaced an equal or an unequal number of degrees apart.

[0057] In this aspect, the interior chamber 110 can have a distally tapered seat 112 that is adapted to selectively receive the ball 120 that is sized to selectively block the distally tapered seat. One skilled in the art will appreciate that the interior chamber 110 of the check valve assembly 100 can be sized and shaped to allow the ball to selectively move axially between an open position, in which the ball is spaced proximally away from the surface of the tapered seat so that pressurized fluid can move through the distal end of the check valve assembly and subsequently through the interior chamber to exit out of the at least one port, and a closed position, in which the ball is pressurized against the surface of the tapered seat so that pressurized fluid cannot move through the check valve assembly.

[0058] In a further aspect, the exterior surface 61 of the elongate tube body 60 can define a plurality of female planar stops 67 proximate the mid-body portion. These female planar stops aid in grasping and selectively orienting the orientation of the core barrel head assembly 30. Optionally, additional female planar stops 69 can

be defined proximate the indicator windows defined in the elongate tube body to aid in ease of selectively orienting the sample.

[0059] Referring now to Figure 8, an alternative embodiment of the core barrel head assembly 30 is shown that comprises at least one electronic instrument 40 that is configured to obtain orientation data, a operatively electrically coupled power source 50 and communication means to receive and/or transmit orientation data.

[0060] In this aspect the core barrel head assembly 130 has a proximal end 132 that is operatively oriented toward the drill bit end of the drill string and an opposed distal end 134. As shown in Figure 8, the core barrel head assembly 130 is conventionally joined to a conventional wire line retrieval portion of a head assembly 10. Thus, the head assembly of the drill string is complete without the necessity for the use of an unwieldy extension tube as required in the prior art designs.

[0061] The core barrel head assembly 130 has an elongate tube body 160 that is operably coupled to elongate hollow spindle 170 that is, in turn, operably coupled to a selectively open check valve assembly 180. The elongate tube body has a threaded proximal end 162 that defines an internal bushing mount 163. The open distal end 164 of the elongate tube body defines an internal shoulder 165 that is sized and shaped to receive at least one conventional cylindrical bearing 190.

[0062] A bushing 192 is mounted in the bushing mount and is sized and shaped to rotatably receive the proximal end 172 of the hollow spindle 170. As shown in the figures, a mid-portion of the hollow spindle is rotatably supported by the at least one bearing 190. In a further aspect, a nut 194 is coupled to a treaded portion 174 of the hollow spindle 170 adjacent to the proximal end of the hollow spindle 170.

[0063] The a portion of the interior wall 165 of the elongate tube body 160, a portion of the nut 194 and a portion of the exterior surface of the hollow spindle define a an interior cavity 166 into which a spring is mounted and the at least one electronic instrument 40 that is configured to obtain orientation data, a operatively electrically coupled power source 50 and communication means to receive and/or transmit orientation data are mounted. The least one electronic instrument 40 that is configured to obtain orientation data, a operatively electrically coupled power source 50 and communication means to receive and/or transmit orientation data can be integrated; potted or otherwise affixed to the elongate tube body within the interior

cavity 166. As one skilled in the art will appreciate, as the hollow spindle turns, the elongate tube body will remain in the same position, *i.e.*, the elongate tube body does not turn when the hollow spindle is turned.

[0064] In an optional aspect, a port 167 is defined that extends from the exterior surface of the elongate tube body into fluid communication with the interior cavity. Optionally, in this aspect, it is contemplated that a grease fitting 168 can be mounted in the port 167 to allow for selective passage of grease or lubricant into communication with the interior cavity.

[0065] It is contemplated that the interior cavity 166 can be sized to hermetically enclose at least one of the least one electronic instrument 40 that is configured to obtain orientation data, the power source 50 and the communication means to receive and/or transmit orientation data. In another aspect, the interior cavity 166 can be sized to hermetically enclose the least one electronic instrument 40 that is configured to obtain orientation data and the power source 50. In one aspect, the at least one electronic instrument 40 can comprise the electronic instrument discussed above and schematically shown in Figures 9 and 10. The at least one electronic instrument 40 is operatively electrically coupled to the power source 50, which can comprise any conventional power source, such as, for example and without limitation, a battery, a rechargeable battery, and the like.

[0066] In a further aspect, to provide fluid control for the wire line operation, a selectively open check valve assembly 180 is provided. In one aspect, the check valve assembly 180 comprises a coupled end assembly 182 defining a proximally tapered seat 184 that defines an interior chamber 185 for operative receipt of a check ball 195.

[0067] In one aspect, the coupled end assembly 182 of the check valve assembly can define a female threaded coupling that is configured to be threadably coupled to the male threads defined on the exterior surface of the distal end 173 of the hollow spindle 170. Thus, as shown in the figures, the tapered seat 184 is operably coupled to the distal end 173 of the spindle 170 such that the hollow interior of the spindle 170 can be selectively placed in fluid communication with fluid governed by the check valve assembly 180.

[0068] As one skilled in the art will appreciate, the end assembly 182 of the check valve assembly defines at least one port 186 that extends from the exterior surface of the check valve assembly and is in fluid communication with the interior chamber of the check valve assembly. In one aspect, the at least one port 186 can comprise a plurality of ports. In this aspect, it is contemplated that the plurality of ports can be angularly spaced an equal or an unequal number of degrees apart.

[0069] In this aspect, the interior chamber 185 can have a proximally tapered seat 184 that is adapted to selectively receive the ball 195 that is sized to selectively block the proximally tapered seat. One skilled in the art will appreciate that the interior chamber 185 of the check valve assembly 180 can be sized and shaped to allow the ball to selectively move axially between an open position, in which the ball is spaced proximally away from the surface of the tapered seat so that pressurized fluid can move out through the elongate spindle into the proximal end of the check valve assembly and subsequently through the interior chamber of the check valve assembly to exit out of the at least one port, and a closed position, in which the ball is pressurized against the surface of the tapered seat so that pressurized fluid cannot move through the check valve assembly to through the hollow spindle.

[0070] In operation, it is contemplated that, in one non-limiting example, the at least one electronic instrument 40 of the core barrel head assembly 30 does not take any orientation measurements while vibrations, such as from the drilling operation, are present. In this aspect, the combination of mechanical, electromechanical and/or electronic sensors and software algorithms programmed into the at least one electronic instrument of the core barrel head assembly are configured to determine that the core barrel head assembly is in motion while descending down the hole and during drilling and is therefore not yet needed to detect breaking of the core sample from the body of material. Similarly, in a further aspect, it is contemplated that the at least one electronic instrument of the core barrel head assembly can be configured to detect that the core barrel head assembly is ascending to the surface for core retrieval after core breaking and subsequently will not take any core orientation measurements during the ascending operation.

[0071] In one non-limiting example, in operation, when the driller is ready to break the core, the driller can selectively not rotate the drill string for a first predetermined delay time period that can range from between about 10 seconds to

about 90 seconds. During the delay time period, it is contemplated that an orientation and dip measurement can be taken during this non-rotation, *i.e.*, minimal vibration, period. Subsequently, after breaking the core, the driller can wait a second predetermined delay time period that can range from between about 60 seconds to about 120 seconds, or at least 90 seconds before initiating further rotation.

[0072] Optionally, it is contemplated that pressure created within the borehole by drilling mud and/or water, which may be pumped down the borehole from the surface can be detected by the at least one electronic instrument 42, which can comprise at least one pressure sensor. In various non-limiting examples, the at least one pressure sensor can be mounted on the drill string, such as on the inner and/or outer drill tube or on the drill bit or on the core barrel head assembly. The detected pressure, such as, for example and without limitation, pressure within the inner tube receiving the core, or pressure differential, such as, for example and without limitation, pressure differential between/across the inner and outer tubes, can be indicative of the inner tube being nearly or totally full of core material. This can occur before the core is separated from the subsurface body of material (such as by breaking the core from the body by a sharp pull back on the core) and hence can provide an indicator that the core is about to be broken.

[0073] Optionally, it is contemplated that the least one electronic instrument 40, which is configured to obtain orientation data, the power source 50 and the communication means to receive and/or transmit orientation data can be sized and shaped to be integrally mounted therein conventional wire line assemblies. In this aspect, the least one electronic instrument 40 that is configured to obtain orientation data, the power source 50 and the communication means to receive and/or transmit orientation data can be miniaturized and/or flexible to be received within defined cavities therein the conventional wire line assemblies and can be subsequently hermetically sealed, such as with, for example and without limitation, an epoxy, therein the defined cavities.

[0074] One skilled in the art will appreciate that the core barrel head assembly 30 does not need to be separated from the head assembly 20 in order to determine core sample orientation and/or to gather data recorded by the tool means that there is less risk of equipment failure and drilling downtime, as well as reduced equipment handling time through not having to separate the sections in order to otherwise obtain core sample orientation. Known systems require an end-on interrogation of

the tool. By providing a sealed apparatus and the facility to determine orientation of the core sample by observing the orientation indications through one or more windows 74 in the side of the elongate tube body 60, reliability and efficiency of core sample collection and orientating is improved. Consequently operational personnel risk injury, as well as additional downtime of the drilling operation. Without having to separate core barrel head assembly 30 from the head assembly, the orientation of the core sample can be determined and the gathered information retrieved with less drilling delay and risk of equipment damage/failure.

[0075] Further, unlike known systems, the core barrel head assembly 30 provides for the desired flow of pressurized fluid in the wire-line assemblies to conventionally operate the fluid control valves that are commonly used in wire-line operations. As noted, the check valve assembly 100 allows for the selectively passage of fluid therethrough that assembly and to the exterior surface of the core barrel head assembly 30 and subsequently through the pressure relief valve to exit out of the first interior cavity of the elongate tube body.

[0076] In one aspect, the one or more pressure sensors 42 can be provided to detect pressure data, which can comprise pressure readings; changes in pressure and/or pressure differentials. The pressure data can be operative communication with the core barrel head assembly 30 and/or an operator at the surface. In one exemplary aspect, once a desired pressure value is detected, drilling can cease and the at least one electronic instrument 40 of the core barrel head assembly 30 can record data relating to the orientation of the core, such as gravitational field strength and direction, and/or magnetic field strength and direction.

[0077] In various aspects, it is contemplated that the recorded data can optionally include "dip" angle or azimuth datum to increase the reliability of the core orientation results. Conventionally, dip is the angle of the inner core tube drill assembly with respect to the horizontal plane and can be the angle above or below the horizontal plane depending on drilling direction from above ground level or from underground drilling in any direction. This provides further confirmation that the progressive drilling of a hole follows a maximum progressive dip angle which may incrementally change as drilling progresses, but not to the extent which exceeds a dogleg severity, *i.e.*, a normalized estimate (*e.g.* degrees / 30 meters) of the overall

curvature of an actual drill-hole path between two consecutive directional survey/orientation stations.

[0078] In operation, prior to obtaining an orientation and core sample, a remote external communication device can be set by an operator to a start time. The remote external communication device communicates with the at least one electronic instrument 40 of the core barrel head assembly 30 before it is tripped into the drill hole. Subsequently, after a predetermined timed interval has elapsed from the start time, the at least one electronic instrument 40 can be configured to begin normal operation to detect the signature of vibration indicating a core break.

[0079] Optionally, in another aspect, pressure changes or levels can be detected to indicate a pre-break condition or period, such as pressure of mud/water within the inner tube increasing due to the core filling or nearly filling the inner tube holding the core.

[0080] In one aspect, the at least one electronic instrument 40 of the core barrel head assembly 30 can be configured to not take any orientation measurements while vibrations, such as from the drilling operation, are present. In this aspect, the combination of mechanical, electromechanical and/or electronic sensors and software algorithms programmed into the at least one electronic instrument 40 of the core barrel head assembly 30 can be configured to determine that the core barrel head assembly is in motion while descending down the hole and during drilling and is therefore not yet needed to detect breaking of the core sample from the body of material. Similarly, in a further aspect, it is contemplated that the at least one electronic instrument 40 of the core barrel head assembly 30 can be configured to detect that the core barrel head assembly is ascending to the surface for core retrieval after core breaking and subsequently will not take any core orientation measurements during the ascending operation.

[0081] Optionally, dip angle can be included in determining orientation of the core. In one aspect, the dip angle of the drill hole can be used to determine whether or not to use the obtained orientation data. For example, a valid core orientation sample can be determined from the previously discussed validation steps being acceptable and, additionally, from the dip angle of the drill hole also being within acceptable limits. In one aspect, the dip can be sampled as a reference prior to the first run of a new drill hole. This particular reference is called a setup function. In this aspect, the setup function can be selected on the remote communications

device, which then communicates to the core barrel head assembly. For clarity, the core sample orientation subassembly does not orientation the core, rather, it records signals indicative of the orientation of the core to be retrieved. The core barrel head assembly can then be lowered down the hole or aligned to the angle of the drill rods in the case of no hole yet to be drilled. Once the core barrel head assembly is down to a desired position or to the end of the hole the user can "mark" the "shot," preferably via use of the remote communications device.

[0082] Subsequently, the core barrel head assembly is retrieved and the remote communications device can be used to communicate the dip (angle) of the drill hole to the communication means of the core barrel head assembly. Optionally, the dip of the end of the hole can be manually entered into the remote communications device and this communicated back to the core barrel head assembly.

[0083] In one aspect, a compliant datum is obtained when one or more signals indicative of the orientation of the core is/are obtained by the core orientation device during a period of no drilling vibration prior to detecting vibration from breaking the core and that being prior to a subsequent period of no drilling vibration. It is contemplated that one or more embodiments can utilize the final compliant datum instead of the first obtained compliant datum.

[0084] In one aspect, it is contemplated that the at least one electronic instrument 40 can comprise an LCD display 41 at one end. This can allow for setting up of the orientation system prior to deployment and to indicate visually alignment of the core sample when retrieved to the surface. The core barrel head assembly 30 can be connected to the core barrel head assembly which can be operably is connected to a sample tube for receiving a core sample. In one aspect, and as exemplarily shown in Figures 8 and 9, the at least one electronic instrument 40 can comprise at least one vibration sensor, at least one accelerometer 43, a memory 45, a timer 47 and the aforementioned LCD display 41. Optionally, at least one electronic instrument 40 can further comprise one or more of at least one of a gravity sensor, magnetic field sensor, inclinometer, a direction measuring sensor, a gyro, and/or preferably a combination two or more of these devices.

[0085] In this aspect, the at least one electronic instrument 40 can be configured to record orientation data every few seconds during core sampling. The start time can be synchronized with actual time using a common stop watch. The

operably coupled core barrel head assembly 30 and the core barrel head assembly can then be lowered into the drill string outer casing to commence core sampling. After drilling and capturing a core sample in the inner core sample tube, the operator, can stop the stop watch and retrieve the core sample tube back to the surface. At the surface, before removing the core sample from the inner tube, the operator can views the LCD display, if it is still working, which steps the operator through instructions to rotate the core tube until the core sample lower section is at the core tube lower end . The core sample is then marked and stored for future analysis.

[0086] Another aspect of the present invention provides a method of conducting a down hole survey of drilling, the method including: a) drilling the core from a subsurface body of material; b) recording data relating to orientation of the core to be retrieved, the data recorded using the at least one electronic instrument of the core barrel head assembly, c) separating the core from the subsurface body, and d) obtaining an indication of the orientation of the core based on the recorded core orientation data obtained before the core was separated from the subsurface body.

[0087] Optionally, the method can comprise: determining that drilling has ceased for a period of time, using the at least one electronic instrument of the core barrel head assembly to record data relating to orientation of the core to be retrieved, separating the core from the subsurface body, retrieving the core to the surface, and obtaining an indication of the orientation of the core based on the recorded core orientation data obtained once the drilling had ceased and before the core was separated from the subsurface body.

[0088] In one exemplary aspect, for the embodiment shown in the flowchart in Figure 11, the core orientation can be validated when the following events have occurred:

- a) Step 200: detecting no vibration above a threshold by the core barrel head assembly, or is detected to be below a threshold, for the first predetermined delay time period;
- b) Step 220: taking a core orientation measurement during the first predetermined delay time period;
- c) Step 230: detecting noise from breaking the core from the subsurface body after the first predetermined delay time period and before the second predetermined delay time period;

d) Step 240: detecting no vibration above a threshold by the core barrel head assembly, or is detected to be below a threshold, for the second predetermined delay time period;

e) Step 250: retaining the orientation measurement obtained in Step 220 only if Steps 200, 230 and 240 are present;

f) Step 260: disregarding detected signals or to not detect vibration or lack of vibration if only if Steps 200, 230 and 240 are obtained. If the detected signals are disregarded, a vibration silence signal in Step 280 must be detected before the core is broken.

[0089] Optionally, as shown in Step 270, a dip measurement can be obtained during the period of no drilling prior to breaking the core (period Y), preferably if dip is within the set limits.

[0090] In one aspect, once the required core orientation is obtained, the core barrel head assembly may be shut down or turned to low power standby mode in Step 290 in preparation to be subsequently placed into an orientation mode. Once the core barrel head assembly 30 is retrieved to the surface in Step 300, an operator can set the core barrel head assembly to the orientation mode in Step 310. In one example, and not meant to be limiting, this can be done via the remote communication means for communicating with the communication means of the core barrel head assembly in Step 320.

[0091] In a further aspect, it is contemplated that the core barrel head assembly can comprise an orientation indicator assembly that comprises one or more lights or other visual indicators, such as, for example and without limitation, one or more display panels to give an indication of orientation direction and required orientation for marking the core. In this aspect, once in orientation mode, visual indications, such as flashing of one or more LEDs, can indicate to the operator which direction to rotate the core to find the "correct down side" for marking. In this aspect, the "correct downside" is the part of the core that was lowermost prior to separating from the subsurface body.

[0092] Once the correct downside is identified in Step 330, the operator can again effect communication to the communication means of the core barrel head assembly via the remote communication device. In Step 340, and based on the orientation data recorded, the remote communication device can be configured to

verify that the correct orientation was achieved. Subsequently, in Step 350, the operator can perform another orientation operation.

[0093] Optional and exemplary methods of using the present invention are shown in Figures 12 and 13. In one aspect, as shown in Figure 12, the at least one electronic instrument 40 of the core barrel head assembly 30 can be programmed to be used in a running mode, a hibernation mode and an orientating mode. In this aspect, the at least one electronic instrument 40 of the core barrel head assembly 30 is configured to actuate and take sequential provisional data readings (POD1, POD2, POD3, etc.) when the at least one electronic instrument senses that vibrations have stopped. These provisional data readings are taken as desired time intervals that can be between about 0.1 to about 1.0 seconds. In this aspect, the core barrel head assembly 30 is configured to actuate or power up when the at least one electronic instrument is taken out hibernation. Further, it is contemplated that the time clock starts operation whenever the at least one electronic instrument 40. For example, this could happen on the surface prior to insertion into the hole. The programming can also optionally disregard any acquired provisional data (POD1, POD2, POD3, etc.) if vibrations are sensed during any portion of the acquisition of the sequential provisional data readings. In this case, the programming would automatically go to the step "Turn Off G-Sensor" in the running mode.

[0094] In one aspect, as shown in Figure 13, the at least one electronic instrument 40 of the core barrel head assembly 30 can be similarly programmed to be used in a running mode, a hibernation mode and an orientating mode. In this aspect, the at least one electronic instrument 40 of the core barrel head assembly 30 is configured to actuate in accord with a time interval scheme in which a signal is sent to the tri-axial g-sensors to take readings in accord with the predetermined time interval scheme.

[0095] In one aspect, it is contemplated that the core barrel head assembly 30 can be utilized in asynchronous time operation for core sampling. In this aspect, the data recording events taken by the core barrel head assembly 30 are not synchronized in time with the communication device. That is, the core barrel head assembly can be programmed to not commence timing from a reference time, and can optionally be programmed such that the at least one electronic instrument 40 of the core barrel head assembly 30 does not take samples (shots) at specific predetermined time intervals. For example, and not meant to be limiting, the at least

one electronic instrument 40 of the core barrel head assembly 30 can be programmed to not take a three second sample every one minute with that one minute interval synchronized to the remote, which would therefore know when each sample is about to take place. In this aspect, the communication means or device is not synchronized to the core orientation unit, *i.e.* asynchronous operation, and therefore the communication device does not know if or when a sample is being taken. Thus, obtaining an indication of core sample orientation is simplified over known arrangements.

[0096] In one aspect, while the core barred head assembly is on the surface, the external communication device can signal to the at least one electronic instrument 40 to activate or come out of a standby mode prior to deployment down hole. Optionally, the at least one electronic instrument 40 can already be activated such that it is not necessary to have the at least one electronic instrument 40 switch on from a deactivated ('turned off') state.

[0097] Alternatively, the at least one electronic instrument 40 can be configured to activate and commence taking data samples after a predetermined period from deployment from the surface or after elapse of an activation delay timer or other delay mechanism. For example, the data gathering device may be configured at the surface to only 'wake-up' from a standby mode to an activated mode after at least a predetermined period of time has elapsed or a counter has completed a predetermined count relating to a time period delay.

[0098] In one aspect, it is contemplated that the at least one electronic instrument 40 can be programmed to take measurements/record orientation data based on the time intervals and/or randomly generated time intervals. In this aspect, the programmed instructions to record data generated as a result of the regular or randomly generated time intervals can remain on-going while the at least one electronic instrument 40 activated. However, because at least one of the sensor(s) in the at least one electronic instrument 40 may be shut down/deactivated during sensed vibrations, no orientation data gets acquired during time period in which vibrations are sensed. When the vibrations stop, the sensors are turned on and the time intervals instructions would then resume execution as per the time regular or random intervals. In this aspect, orientation data is being measured/obtained per the time intervals being used, as preferably initiated at the beginning of the run or after a delay timer. But, data will not be recorded during the

time intervals due to the fact that the sensor(s) will be off/deactivated, e.g. during a time period in which vibrations are sensed. In this aspect, when drilling ceases, which results in vibrations ceasing, data will be taken, and may preferably continue to be taken, in accordance with the time intervals scheme initiated at the surface, and preferably may always running in the background even when the sensor(s) is/are off or deactivated (e.g., asleep).

[0099] In a further aspect, the at least one electronic instrument 40 can log and/or record orientation related data down hole at intervals (regular or randomly generated intervals within minimum and maximum interval time limits) and can also measures total lapsed survey time T.

[00100] In a further aspect, the at least one electronic instrument 40 can be started by an external communication device at the surface but a second, different, communication device can be used to 'mark' (to set) the point in time, i.e., to commence the elapsed period of time t relating to breaking the core sample from the underlying rock and thereby be used for identifying the data set recorded immediately before that break.

[00101] In one aspect, to compensate for taking regular or random time period orientation measurements, which uses up battery power as the at least one electronic instrument 40 advances down hole, a start delay can be provided. For example, when the external communication device at the surface is operated, e.g., turned on, an option to set a delay time in the at least one electronic instrument 40 may be displayed. For example, a delay in minutes between 0 to 99 minutes might be displayed. In this aspect, when the at least one electronic instrument 40 is started-up and the communication device communicates the delay period to the at least one electronic instrument 40, the timer in the at least one electronic instrument 40 will allow the delay period to elapse before any orientation measurements are recorded.

[00102] In one aspect, orientation data can be recorded while drilling is ceased and closest to time T_x , where T_x is preferably less than or equal to $T-t$, and where T is the time recorded by the at least one electronic instrument 40 (survey time) and t is the elapsed time recorded by the external communication device that was commenced once drilling ceased and the orientation data was recorded. In this exemplary aspect, it will be appreciated that the required recorded data may be at a

time T_x greater than $T-t$, *i.e.*, if the drilling remained ceased after commencing the elapsed time and separating (breaking) the core sample from the rock was delayed while the at least one electronic instrument 40 recorded orientation data. Thus, T_x can be greater than $T-t$ providing no drilling activity takes place after drilling ceases and before the core is broken from the underlying rock. In this aspect, in operation, when the core barrel head assembly 30 is retrieved back at the surface with the core sample), the external communication device interrogates the at least one electronic instrument 40 to identify the recorded core orientation data closest to $T-t$, *i.e.*, the timer of the external communication device is not synchronised to the timer of the at least one electronic instrument 40, and both timers are not commenced at a reference time.

[00103] For example and without limitation, orientation data may be recorded by the at least one electronic instrument 40 at regular irregular intervals of time within a known range of allowed time intervals, such as one or more of 10s, 15s, 20s or 30s intervals within a range of 1s to 1 minute. It is contemplated that the time intervals can be generated by a random (time) number generator operating within the minimum and maximum allowed range. Thus, the time intervals for obtaining orientation data may be repeated (e.g. 10s, 10s, 10s, 20s, 20s, 10s...). In this exemplary aspect, data recording events ('shots') are therefore not constantly taken on a set time period. However, it is contemplated that predetermined set time intervals may be used. That is, the at least one electronic instrument 40 may record orientation data every time interval, preferably up until the core is broken from the underlying rock, though recording may also continue afterwards.

[00104] In operation, the at least one electronic instrument 40 can be deployed down hole. Optionally, the at least one electronic instrument 40 can be started at the surface and its timer commence the survey time timing at the surface, or the timer can have a delay to save power until the at least one electronic instrument 40 is all or partway down the borehole. Subsequently, when the core sample has been captured sufficiently in the core tube, drilling ceases and during this period of non-drilling, the at least one electronic instrument 40 records orientation data relating to its own orientation in the borehole, and therefore, of the associated core sample that is captured in the core barrel head assembly 30, which cannot rotate unless the at least one electronic instrument 40 also rotates. Next, the core sample is broken

away from the underlying rock and the core barrel head assembly 30 is retrieved to the surface.

[00105] In one aspect, an external communication device can record the elapsed time t by a user, *i.e.*, commencing the timer in the handheld external communication device at the surface. This is preferably either when drilling has ceased or immediately before breaking the core from the rock while drilling has ceased, or immediately after the core is broken. However, it will be appreciated that the elapsed time can be commenced after the core is broken away from the underlying rock because the at least one electronic instrument 40 can be programmed to identify the nearest recorded data older than the commencement of the elapsed time that occurred during no drilling. In this aspect, the external communication device retains a record of the elapsing time.

[00106] When the at least one electronic instrument 40 and core barrel head assembly 30 containing the core sample are retrieved to the surface, the user can interrogate the at least one electronic instrument 40. In this aspect, once the at least one electronic instrument 40 confirms receiving the interrogation command, the communication device can command halting of the survey time T (stopping the at least one electronic instrument 40's timer) and elapsed time t (stopping the external communication device's timer). In this aspect, the external communication device can instruct the at least one electronic instrument 40 to identify the recorded orientation data from immediately before or after the commencement of the elapsed period of time going back from the end of the survey time, *i.e.*, the at least one electronic instrument 40 has to 'look back' in time for the data recorded at or around the elapsed ago. In this aspect, the at least one electronic instrument 40 subtracts the elapsed time t from its survey time T to provide a time T_x associated with the required recorded data obtained when drilling was ceased.

[00107] In this aspect, once the correct recorded orientation data is identified in its memory, the at least one electronic instrument can go into orientation mode so that the core sample can be orientated and that orientation recorded. In one exemplary aspect, recording of orientation data by the at least one electronic instrument 40 is triggered on a time interval basis; this may be by the regular or random time intervals mentioned above. Recording the orientation data may only commence once the time delay has ended. For example, the timer within the at

least one electronic instrument 40 may be running from deployment (or before) of the device into the borehole. However, the delay may prevent the device from recording orientation data until the delay has ended. Once the delay has ended, orientation data is recorded according to the prevailing time interval sequence, *i.e.*, randomly generated time intervals or regular time intervals.

[00108] Optionally, when vibration or other motion of the at least one electronic instrument 40 stops down hole sufficiently, the at least one electronic instrument 40 may resume recording orientation data according to the prevailing time interval regime or may switch to another time interval regime for sensing and recording orientation.

[00109] Optionally, the at least one electronic instrument 40 can be programmed to identify core orientation data recorded before breaking of the core sample but based on an elapsed time period commenced after breaking the core sample. The at least one electronic instrument 40 can be programmed to identify the recorded orientation data that that was recorded before commencement of the elapsed time. In a further aspect, the recorded data can be recorded after breaking of the core sample because of the time interval recording regime. In this aspect, if that data set was recorded while nothing was moving down hole (and has not moved since breaking the core), the data set can be trusted to be sufficiently accurate. It can be compared with one or more previous data sets, and if they concur, then can be deemed sufficiently accurate for orientation purposes. Only one of those data sets is needed and any other of them may be discarded or disregarded.

[00110] In a further aspect, it is contemplated that operation of the at least one electronic instrument 40 to commence recording orientation data can be initiated at the surface and device then deployed into the borehole. Commencement of recording orientation data can also be delayed, so as to save battery power by avoiding taking unnecessary or unusable orientation measurements whilst the device is progressing down the borehole. Orientation measurement immediately before or after breaking the core sample from the underlying rock is/are required. In one exemplary aspect, the at least one electronic instrument 40 can have a delay preventing recording of orientation data until the delay ends.

[00111] In another aspect, the at least one electronic instrument 40 can take orientation measurements periodically, such as at random or regular periods of time, and record one or more of those measurements. Preferably the at least one electronic instrument 40 can be in a sleep mode, change to a power-up (wake-up) mode and then take a measurement, and re-enter sleep each interval. In one aspect, if two or more consecutive orientation measurements are the same, the at least one electronic instrument 40 can ignore, not record or delete from memory unnecessary repeat measurements and only retain one of the repeat measurements, preferably being the first of the identical measurements. In this aspect, each recorded measurement of orientation can be tagged or 'time stamped', preferably relative to the timer running in the at least one electronic instrument 40, *i.e.*, the recorded orientation data is given a time stamp Tx, where x is the particular time within the survey timeframe running in the device. Thus, Tx is the time since the survey time T commenced that that orientation data set was recorded. It is contemplated that Tx can be a real time or cumulative time since commencement of the survey time T. Thus, in this aspect, the at least one electronic instrument 40 can have a real time clock type timer or a 'start-stop' (counter or stopwatch) type timer. When drilling ceases and the core is to be broken from the underlying rock (because there is sufficient core sample in the core barrel), a 'mark' is taken, which commences an elapsed time t at the surface. In this aspect, it is contemplated that this mark can be taken before or after the break at either regular or irregular time intervals.

[00112] Referring now to Figure 14, an exemplary known hand held device 400 which wirelessly receives data or signals from the communication means of the core barrel head assembly. In this aspect, communication means of the core barrel head assembly comprises a transmitter which can use line of sight data transfer through the window, such as by infra-red data transfer, or a wireless radio transmission. The communication device 400 can store the signals or data received from the communication means of the core barrel head assembly. In one aspect, the communication device 400 can comprise a display 402, navigation buttons 404, 406, and a data accept confirmation button 408.

[00113] In one aspect, setting up of the core barrel head assembly 30 can be carried out before insertion into the drill hole. Data retrieval can be carried out by

infrared communication between the communication means of the core barrel head assembly and a core orientation data receiver or communication device 400. In this aspect, after recovering the core sample inner tube back at the surface, and before removing the core sample from the tube, the operator can optionally remove the head assembly. The operator can use the remote communication device to obtain orientation data from the communication means of the core barrel head assembly using a line of sight wireless infrared communication between the remote device and communication means of the core barrel head assembly. However, it will be appreciated that communication of data between the communication means of the core barrel head assembly and the communication device 400 can be by other wireless means, such as by radio transmission.

[00114] In this prior art aspect, the whole inner tube, core sample, and core barrel head assembly can be rotated as necessary to determine a required orientation of the core sample. The indicators on the proximal end of the core barrel head assembly indicate to the operator which direction, clockwise or anti-clockwise, to rotate the core sample. One color of indicator can be used to indicate clockwise rotation and another color can be used to indicate anticlockwise rotation is required. This is carried out until the core sample is oriented with its lower section at the lower end of the tube. The core sample is then marked for correct orientation and then used for analysis.

[00115] In one aspect, it is contemplated that the visual and/or audible orientation indicators, under certain site and/or environmental conditions, may not be sufficiently visible or audible. Thus, an additional or alternative means and/or method may be utilized to ensure that the core sample has been correctly oriented. In this embodiment, the exterior surface 61 of the body of the core barrel head assembly 30 can have angular degree marks that optionally are scribed/ etched, machined, molded or otherwise provided, such as by printing or painting, on the exterior surface 61. For example, dashes can be equally spaced around the outside parameter represent one or more angular degrees of the full circle or perimeter. Further scribing of a number every five dashes starting with the number 0 then 5, 10, 15 etc. until 355.

[00116] When the core is retrieved and the communication means of the core barrel head assembly communicates with the hand held communicator 400, additional information can be transmitted from the core barrel head assembly to the

communicator 400, such as a number between zero 0 and 359 (inclusive) denoting an angular degree of rotation of core barrel head assembly and the core sample. When the core is oriented during one or more embodiments of the method of the present invention, the numerical scribing the core barrel head assembly should be the same as the number transmitted, to the communicator 400, which re-confirms correct orientation. Thus, if the visual or audible means for indicating core orientation are not useful or available, then the core can be oriented using the angular degree arrangement to match the transmitted number, and then can be audited using the communicator 400.

[00117] Embodiments of the present invention provide the advantage of a fully operating down hole core barrel head assembly without having to disconnect or disassemble any part of the tool/device from the inner tube and/or from the head assembly or any other part of the drilling assembly that the core barrel head assembly would need to be assembled within for its normal operation.

Disconnecting or disassembling the core barrel head assembly from the head assembly and/or inner tube risks failure of seals at those connections and/or risks cross threading of the joining thread. Also, because those sections are threaded together with high force, it takes substantial manual force and large equipment to separate the sections. High surrounding pressure in the drill hole means that the connecting seals between sections function to prevent water and dirt from ingressing into and damaging the device.

[00118] Although several embodiments of the invention have been disclosed in the foregoing specification, it is understood by those skilled in the art that many modifications and other embodiments of the invention will come to mind to which the invention pertains, having the benefit of the teaching presented in the foregoing description and associated drawings. It is thus understood that the invention is not limited to the specific embodiments disclosed hereinabove, and that many modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although specific terms are employed herein, as well as in the claims which follow, they are used only in a generic and descriptive sense, and not for the purposes of limiting the described invention, nor the claims which follow.

What is claimed is:

1. A core barrel head assembly, comprising:
 - an elongate tube body defining a selectively sealed interior cavity;
 - at least one electronic instrument that is configured to obtain orientation data mounted therein the sealed interior cavity, wherein the at least one electronic instrument comprises at least one digital and/or electro-mechanical sensors in a core orientation data recording tool that can be configured to determine a core orientation of a sample core just prior to or after the core break;
 - a power source in operable communication with the at least one electronic instrument, wherein the power source is mounted therein the interior cavity; and
 - communication means to receive and/or transmit core orientation data.
2. The core barrel head assembly of Claim 1, wherein the elongate tube body has a threaded proximal end for coupling to a wire line retrieval portion of a head assembly.
3. The core barrel head assembly of Claim 1, wherein the elongate tube body has a first interior cavity that extends distally to a base portion of the tube body.
4. The core barrel head assembly of Claim 3, wherein the selectively sealed interior cavity is spaced from and extends distally from the first interior cavity.
5. The core barrel head assembly of Claim 4, wherein a port is defined proximate the base portion of the sealed interior cavity that extends from the exterior surface of the elongate tube body into fluid communication with the first interior cavity.
6. The core barrel head assembly of Claim 5, wherein a pressure fitting is mounted in the port to allow for selective passage of fluid to and from the exterior surface of the barrel head assembly into communication with the first interior cavity
7. The core barrel head assembly of Claim 1, wherein the sealed interior cavity is sized and shaped to hermetically enclose at least one of the least one electronic instrument, the power source , and the communication means to receive and/or transmit orientation data.

8. The core barrel head assembly of Claim 1, wherein the sealed interior cavity is sized and shaped to hermetically enclose the least one electronic instrument and the power source
9. The core barrel head assembly of Claim 1, further comprising a plurality of windows defined in the elongate tube body that extend from the exterior surface of the elongate tube body into optical communication with the sealed interior cavity proximate a closed proximal end of the sealed interior cavity
10. The core barrel head assembly of Claim 9, further comprising an orientation indicator module comprising a plurality of light emitters.
11. The core barrel head assembly of Claim 10, wherein the orientation indicator module is sized and shaped to sealingly close the sealed interior cavity from any intrusion of pressurized fluid into the sealed interior cavity via the plurality of windows.
12. The core barrel head assembly of Claim 10, wherein the orientation indicator module is configured to orient or otherwise position the plurality of light emitters so that each light emitter underlies one window.
13. The core barrel head assembly of Claim 10, wherein the orientation indicator module further comprises a first sealing means for preventing any pressurized fluid from entering the sealed interior cavity from the plurality of windows defined in the elongate tube body.
14. The core barrel head assembly of Claim 13, wherein the first sealing means comprises at least one O-ring seal that is mounted on an exterior portion of the orientation indicator module and that is configured to seal between an exterior portion of the orientation indicator module and a portion of an interior surface of the sealed interior cavity.
15. The core barrel head assembly of Claim 14, wherein the sealed interior cavity can comprised at least one orienting slot defined therein.
16. The core barrel head assembly of Claim 14, wherein a desired position of the orientation indicator module is maintained relative to at least one O-ring seal.
17. The core barrel head assembly of Claim 1, wherein the sealed interior cavity extends distally to an open threaded distal end of the elongate tube body.

18. The core barrel head assembly of Claim 18, further comprising a seal coupler that is configured to be sealingly received in the open threaded distal end of the elongate tube body.

19. The core barrel head assembly of Claim 18, further comprises a second sealing means for preventing any pressurized fluid from entering the sealed interior cavity.

20. The core barrel head assembly of Claim 19, wherein the second sealing means comprises at least one O-ring seal that is mounted on a portion of the seal coupler and that is configured to seal between a portion of the seal coupler and a portion of an interior surface of the open distal end of the elongate tube body.

21. The core barrel head assembly of Claim 18, further comprising a check valve assembly configured to affect a hermetical seal of the sealed interior cavity and to provide fluid control for wire line operation.

22. The core barrel head assembly of Claim 21, wherein the check valve assembly comprises a coupled proximal end assembly and a distally tapered seat that defines an interior chamber for operative receipt of a check ball.

23. The core barrel head assembly of Claim 22, wherein the proximal end assembly defines a female threaded coupling that is configured to be threadably coupled to male threads defined on an exterior surface of a distal end of the elongate tube body.

24. The core barrel head assembly of Claim 23, wherein, when the proximal end assembly is threadably coupled to the distal end of the elongate tube body, the seal coupler is driven into a sealed position therein the sealed interior cavity to affect complete hermeticity.

25. The core barrel head assembly of Claim 22, wherein the interior chamber of the check valve assembly extends to a distal end of the check valve assembly, and wherein the check valve assembly further defines at least one port that extends from an exterior surface of the check valve assembly and is in fluid communication with the interior chamber of the check valve assembly.

26. The core barrel head assembly of Claim 25, wherein the interior chamber has a distally tapered seat that is adapted to selectively receive the check ball that is sized to selectively block the distally tapered seat.

27. The core barrel head assembly of Claim 26, wherein the interior chamber is sized and shaped to allow the check ball to selectively move axially between an open position, in which the check ball is spaced proximally away from the surface of the tapered seat so that pressurized fluid can move through the distal end of the check valve assembly and subsequently through the interior chamber to exit out of the at least one port, and a closed position, in which the check ball is pressurized against the surface of the tapered seat so that pressurized fluid cannot move through the check valve assembly.

28. The core barrel head assembly of Claim 1, wherein an exterior surface of the elongate tube body defines a plurality of female planar stops proximate the mid-body portion.

29. The core barrel head assembly of Claim 1, wherein the at least one electronic instrument is programmed to obtain orientation data when the at least one electronic instrument senses no relative movement of the at least one electronic instrument.

30. The core barrel head assembly of Claim 29, wherein the at least one electronic instrument is programmed to obtain orientation data when the at least one electronic instrument senses no vibrations.

31. The core barrel head assembly of Claim 30, wherein the at least one electronic instrument does not take any orientation measurements if vibrations are sensed by the at least one electronic instrument.

32. The core barrel head assembly of Claim 29, wherein the at least one electronic instrument is programmed to not obtain orientation data when the at least one electronic instrument determines that the core barrel head assembly is in motion while descending down or ascending up the hole and during drilling.

33. The core barrel head assembly of Claim 1, wherein the at least one electronic instrument is programmed to obtain orientation data based on a predetermined time interval scheme.

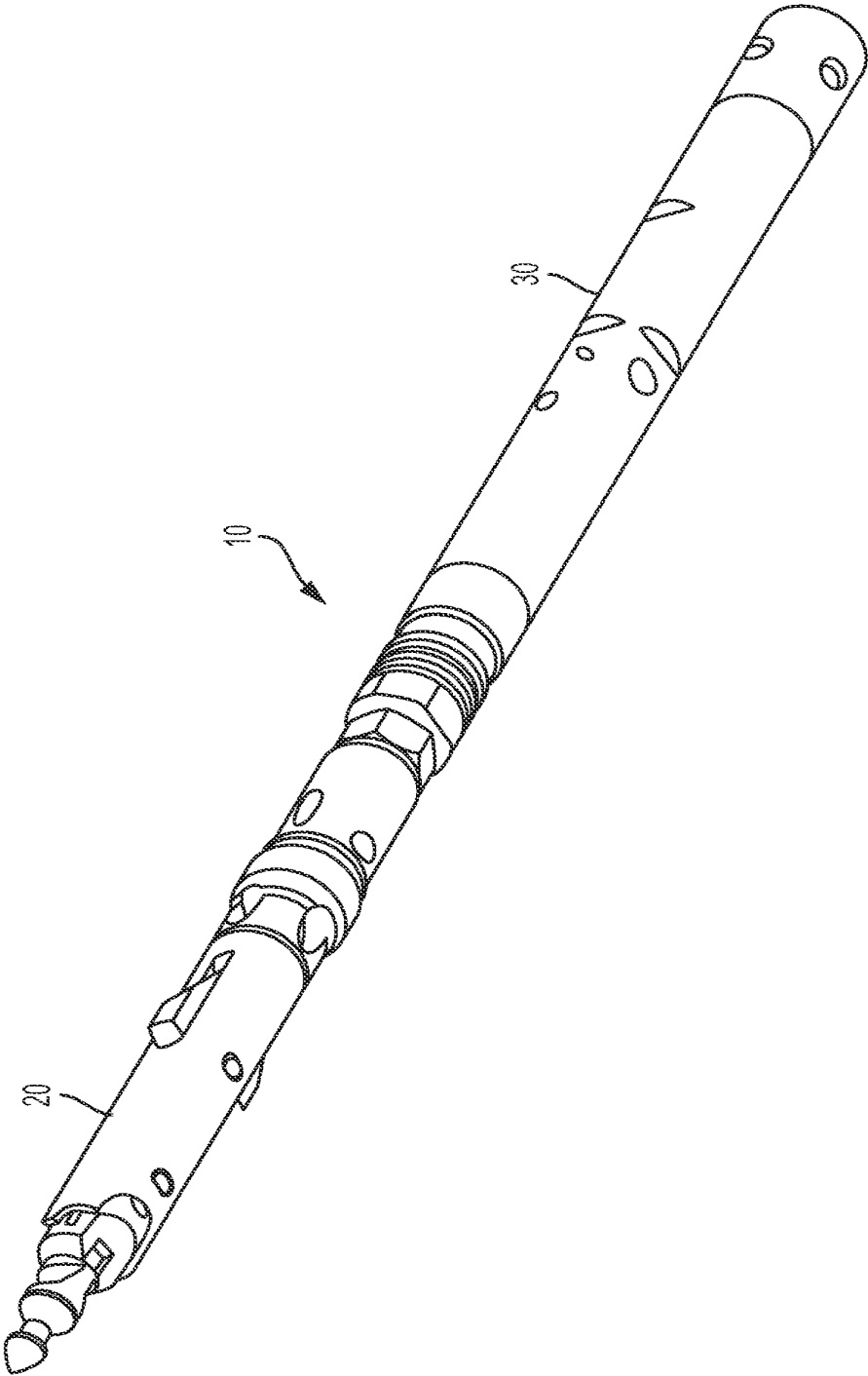


FIG. 1

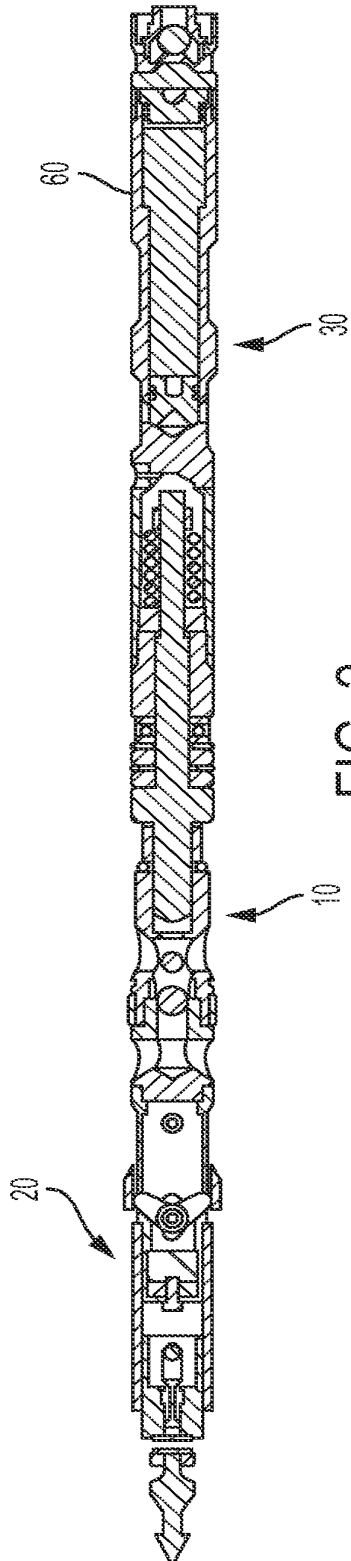


FIG. 2

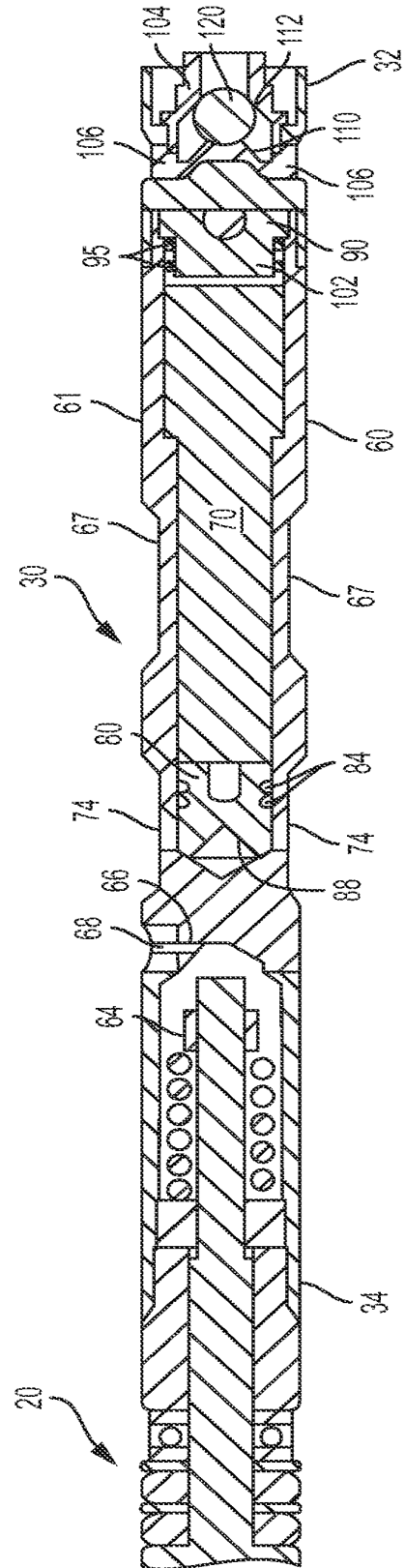


FIG. 3

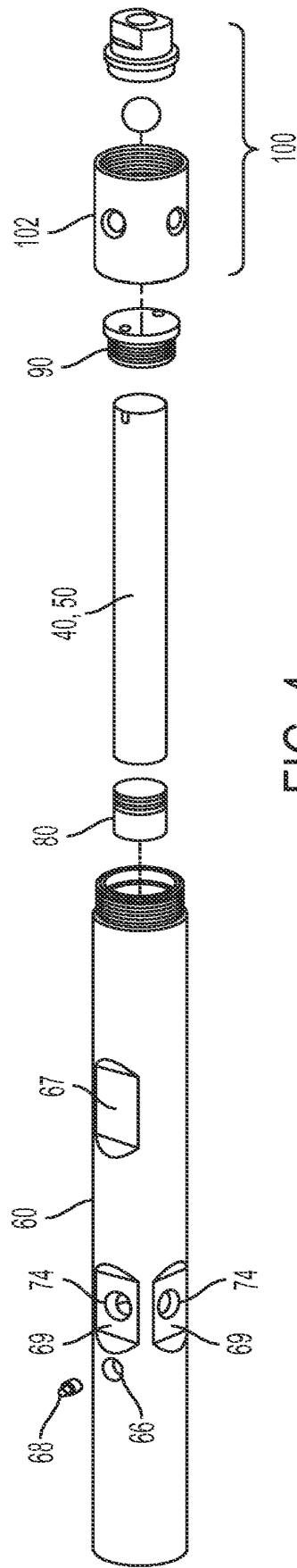


FIG. 4

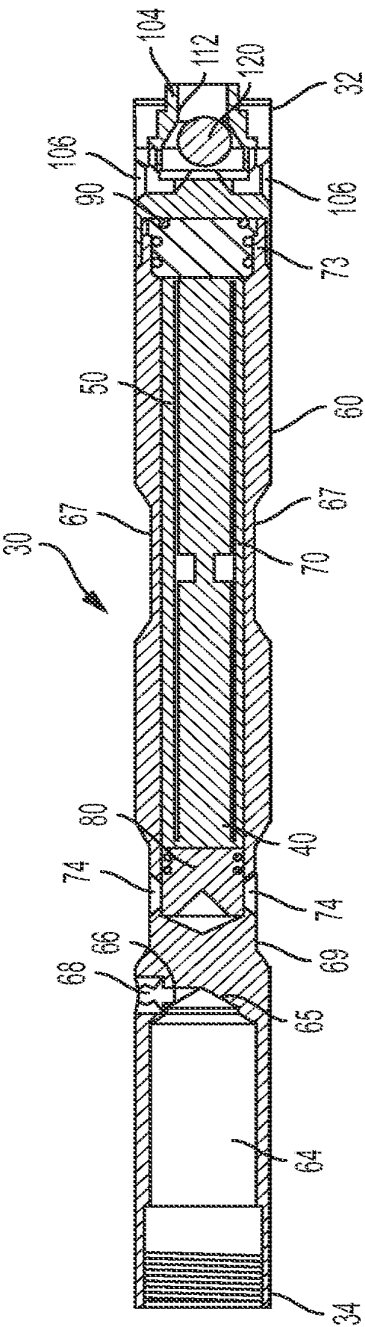


FIG. 5

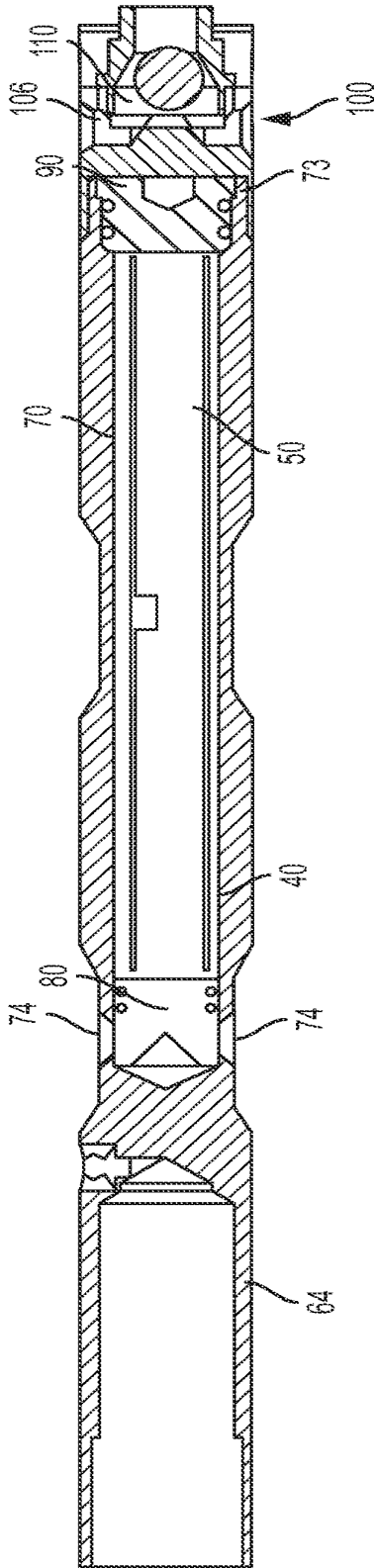


FIG. 6

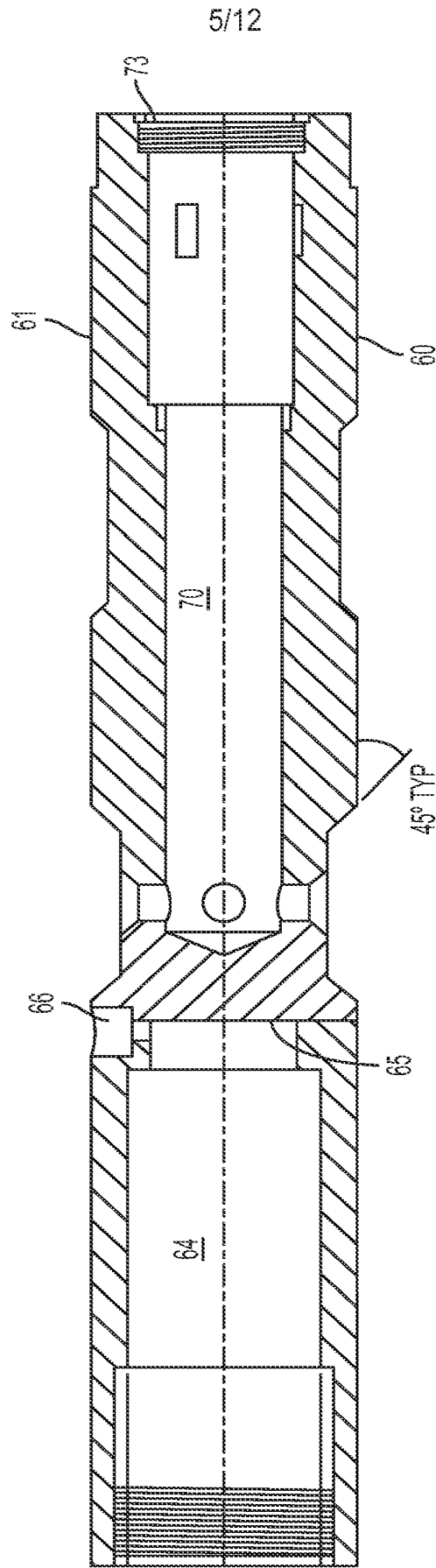


FIG. 7

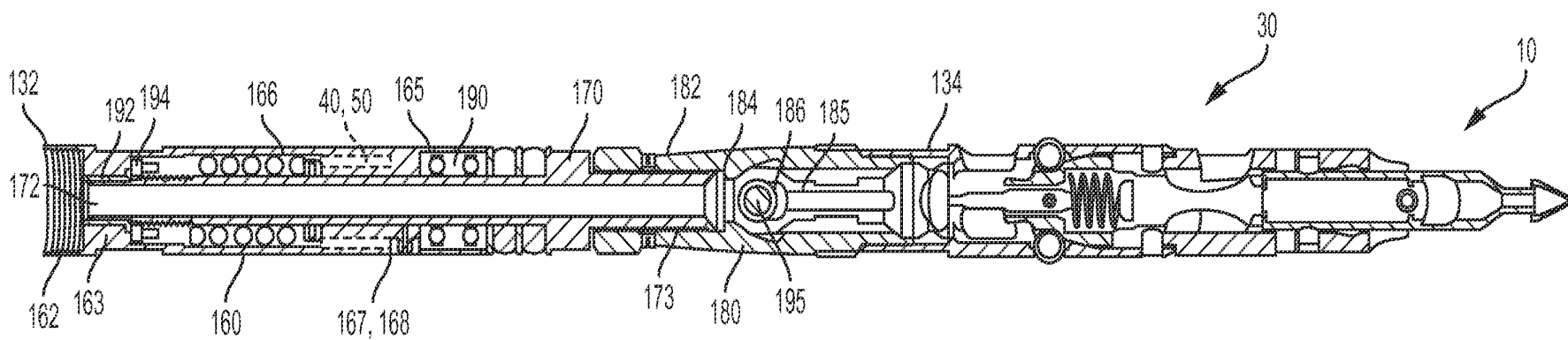


FIG. 8

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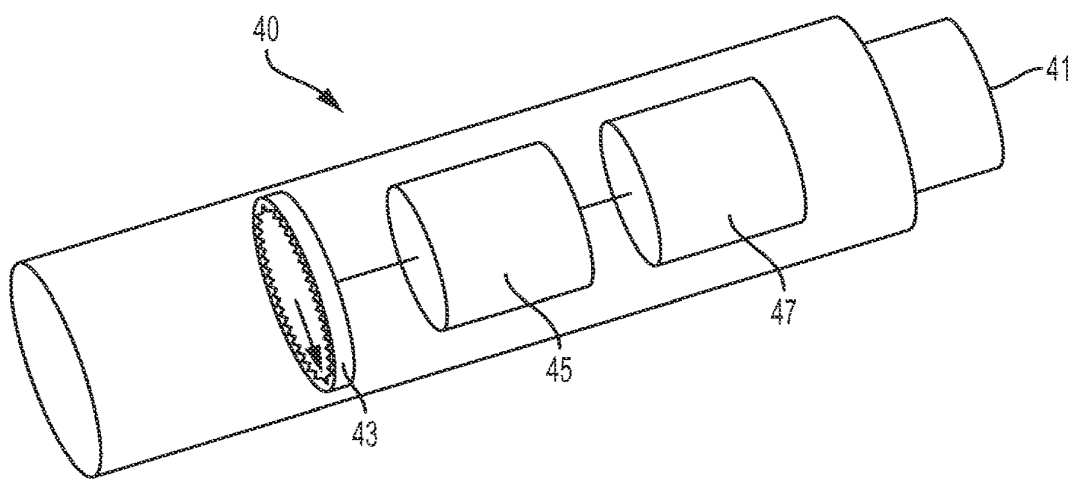


FIG. 9

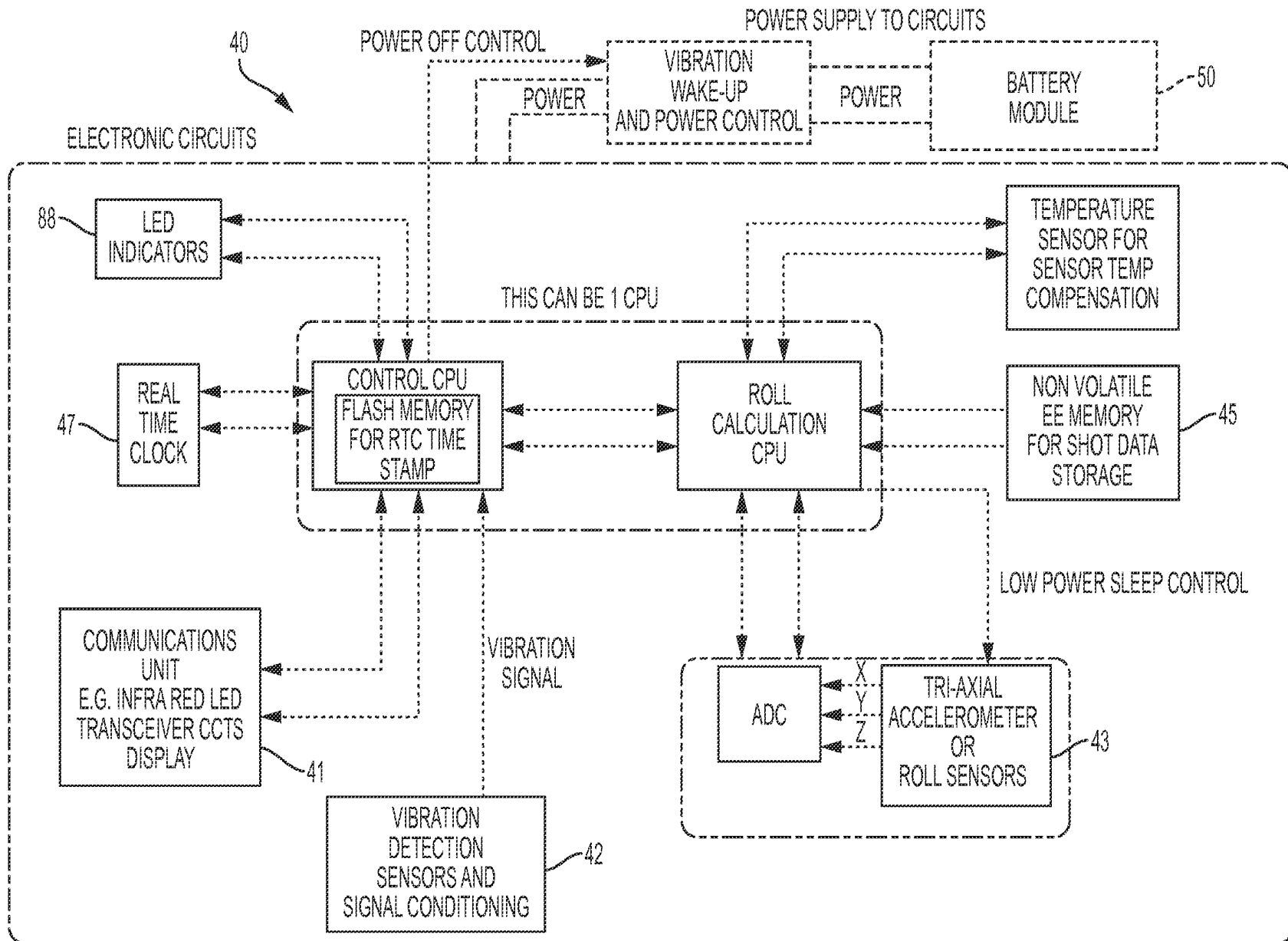


FIG. 10

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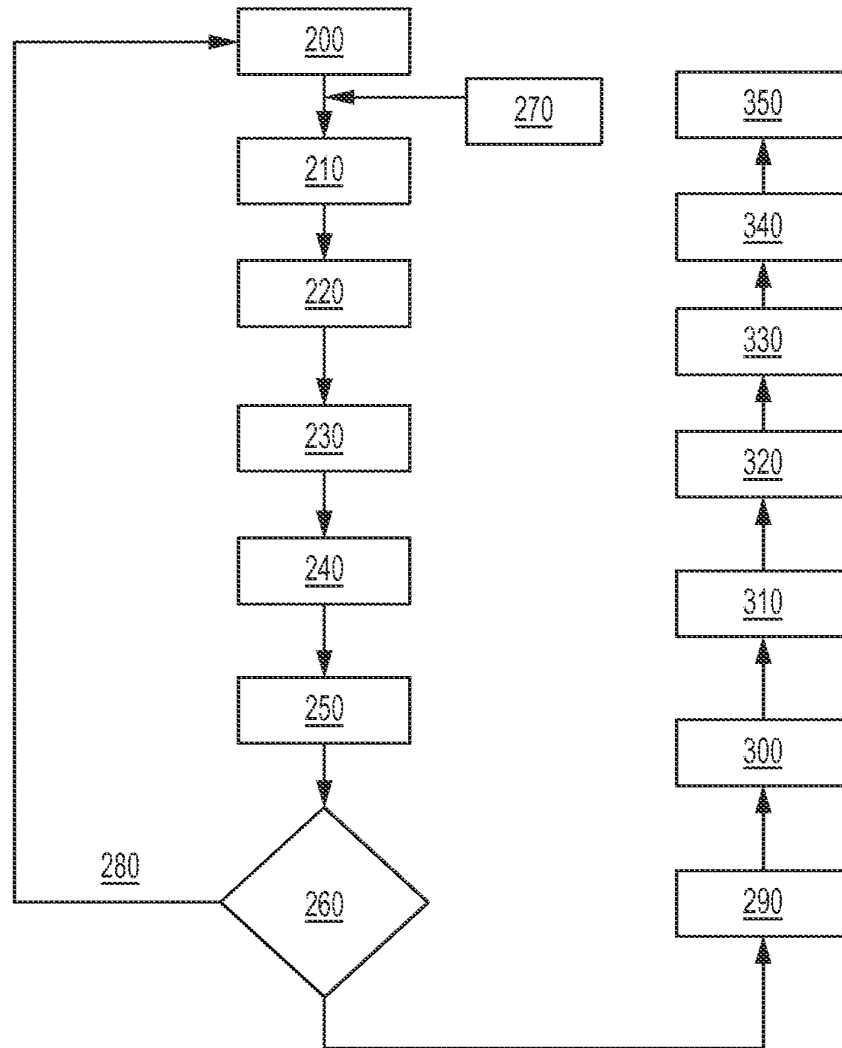


FIG. 11

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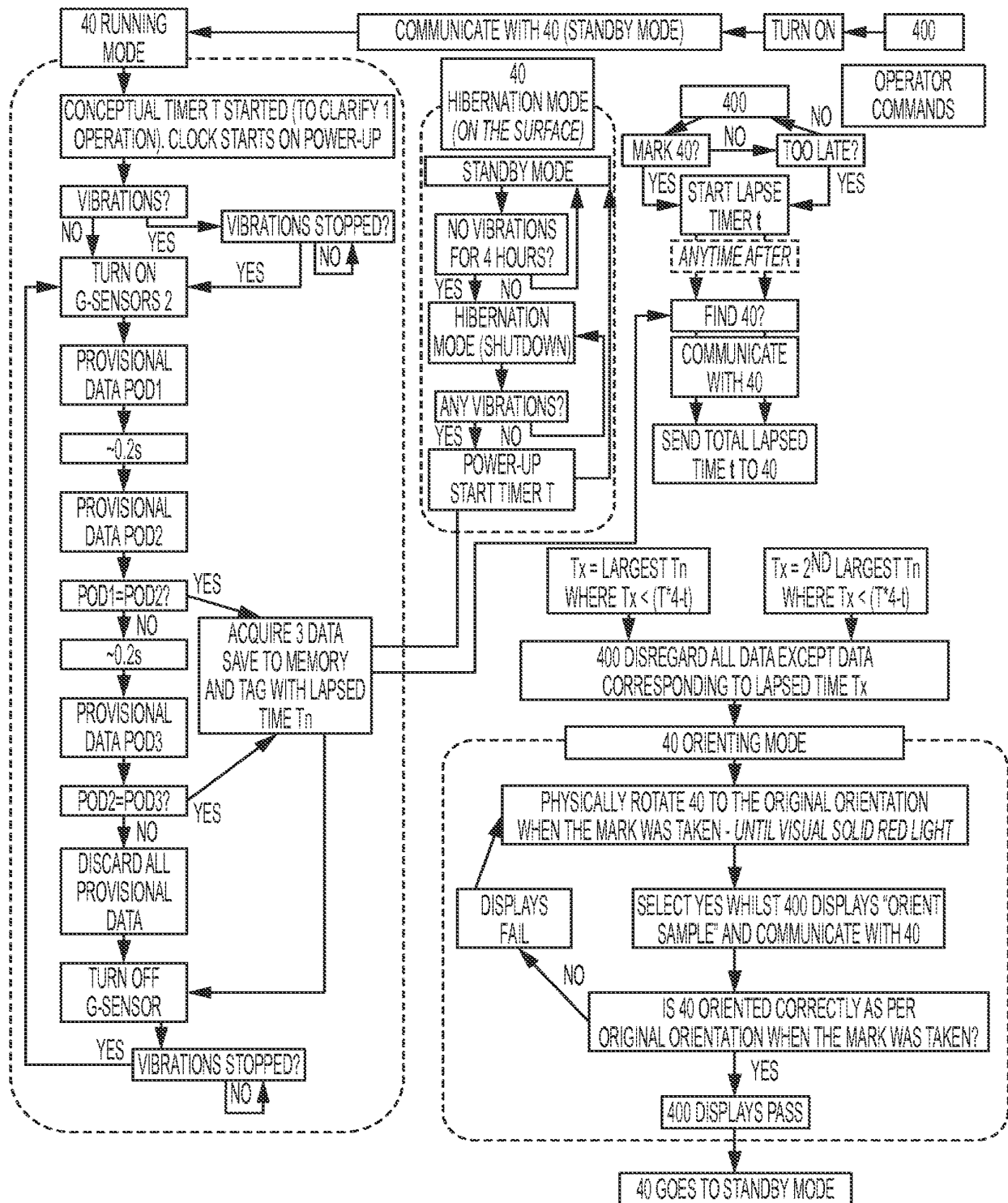


FIG. 12

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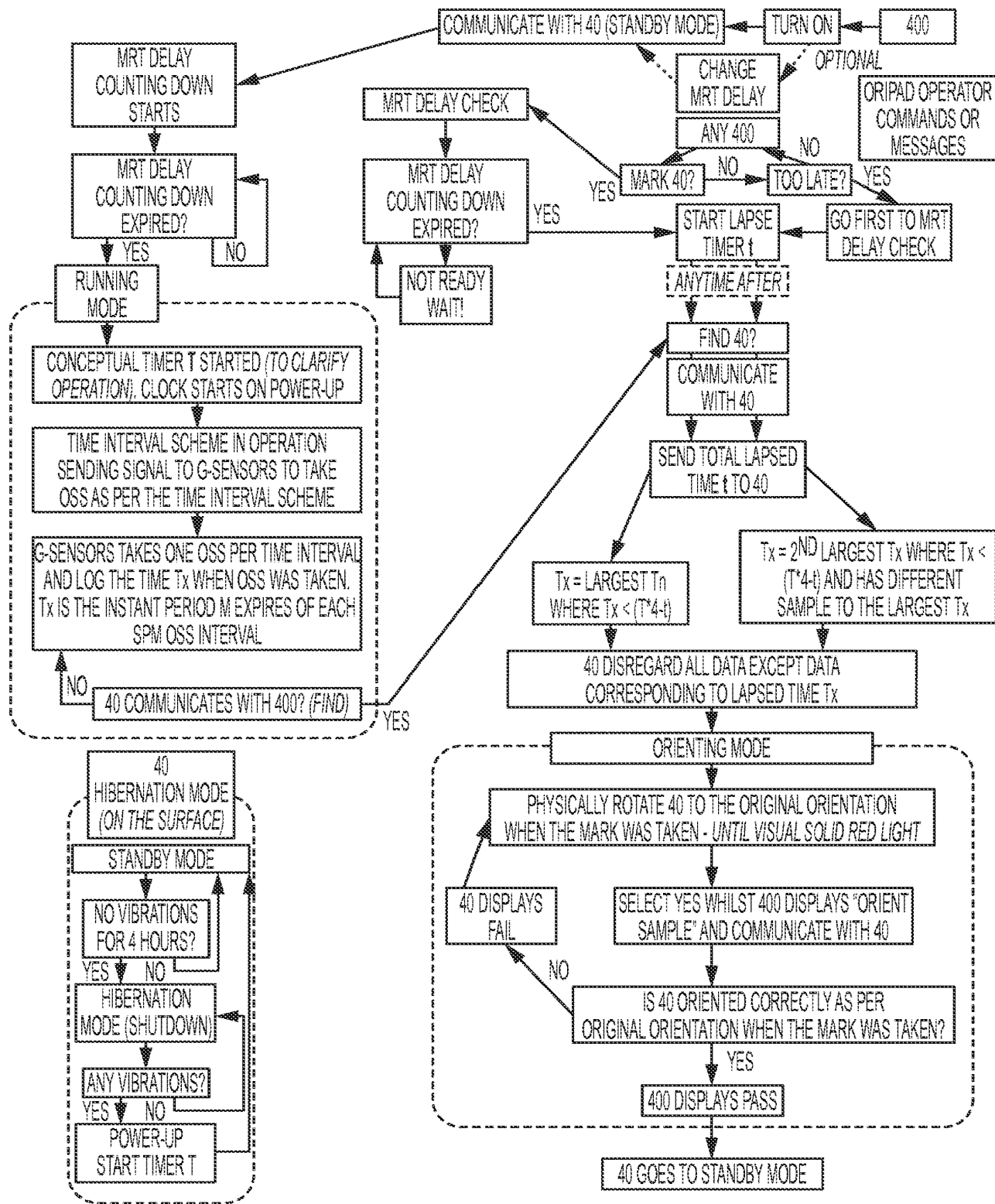


FIG. 13

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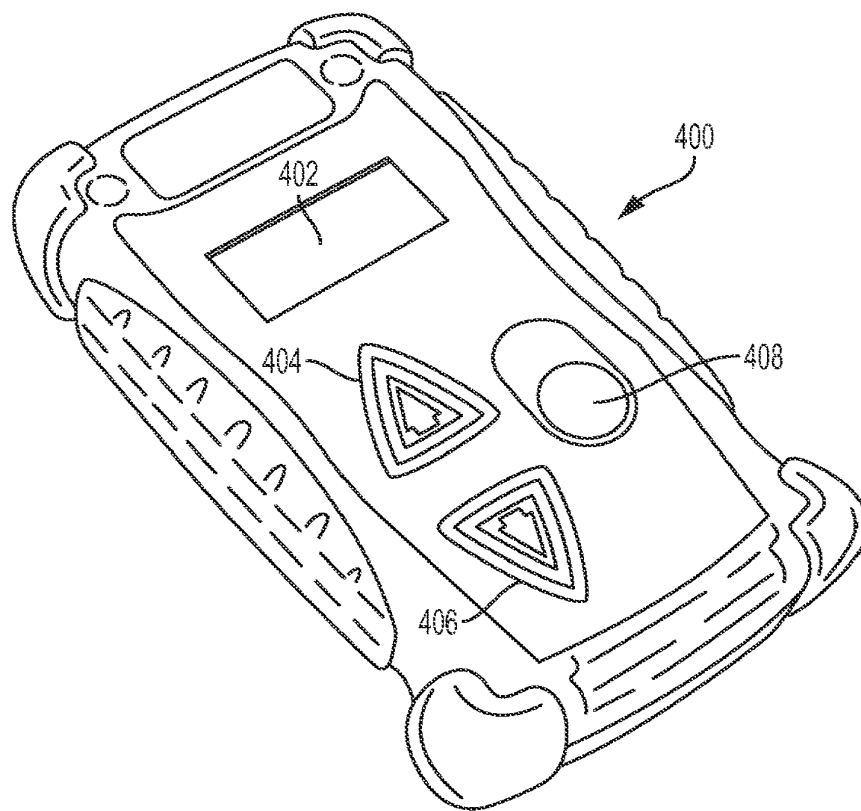


FIG. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/026907**A. CLASSIFICATION OF SUBJECT MATTER****E21B 10/02(2006.01)i, E21B 49/02(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
E21B 10/02; E21B 49/02; E21B 25/16; E21B 25/00; E21B 49/00Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility modelsElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: core barrel, core sample, orientation, electronic instrument, port, window, light emitter, seal coupler**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008-113127 A1 (21C AUSTRALIA PTY LTD. et al.) 25 September 2008 See page 11, line 30 - page 12, line 28; page 14, lines 7-21; page 16, lines 12-22; page 26, lines 5-18 and figures 1-2.	1-4, 7-8, 17, 28-33
A		5-6, 9-16, 18-27
A	WO 2014-053012 A1 (MINNOVARE PTY LTD.) 10 April 2014 See paragraph [0035] and figure 1.	1-33
A	WO 2007-104103 A1 (21C AUSTRALIA PTY LTD. et al.) 20 September 2007 See page 6, line 16 - page 7, line 12 and figure 1.	1-33
A	US 2012-0145461 A1 (CRAVATTE, PHILLIPE) 14 June 2012 See paragraphs [0047]-[0058] and figures 1-3.	1-33
A	US 6732818 B2 (GREGORY, FRANK) 11 May 2004 See abstract and claim 1.	1-33



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

24 July 2015 (24.07.2015)

Date of mailing of the international search report

24 July 2015 (24.07.2015)

Name and mailing address of the ISA/KR


 International Application Division
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 Republic of Korea

Facsimile No. +82-42-472-7140

Authorized officer

HWANG, Chan Yoon

Telephone No. +82-42-481-3347



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/026907

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008-113127 A1	25/09/2008	AU 2008-100249 A4 AU 2008-229644 A1 AU 2008-229644 B2 EP 2134921 A1	12/06/2008 25/09/2008 16/06/2011 23/12/2009
WO 2014-053012 A1	10/04/2014	None	
WO 2007-104103 A1	20/09/2007	None	
US 2012-0145461 A1	14/06/2012	EP 2072749 A2 EP 2072749 A3 EP 2072749 B1 US 2009-0159335 A1 US 2011-0083905 A1 US 7878269 B2 US 8146684 B2 US 8297376 B2	24/06/2009 19/01/2011 11/07/2012 25/06/2009 14/04/2011 01/02/2011 03/04/2012 30/10/2012
US 6732818 B2	11/05/2004	US 2004-065478 A1	08/04/2004

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 36362.0150P1	FOR FURTHER ACTION	See item 4 below
International application No. PCT/US2015/026907	International filing date (<i>day/month/year</i>) 21 April 2015 (21.04.2015)	Priority date (<i>day/month/year</i>) 21 April 2014 (21.04.2014)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant LONGYEAR TM, INC.		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 9 sheets, including this cover sheet. In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																								
3.	This report contains indications relating to the following items: <table style="width: 100%; border: none;"> <tr> <td style="width: 10%; text-align: center;">☒</td> <td style="width: 30%;">Box No. I</td> <td style="width: 80%;">Basis of the report</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☒	Box No. VIII	Certain observations on the international application
☒	Box No. I	Basis of the report																							
☐	Box No. II	Priority																							
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability																							
☐	Box No. IV	Lack of unity of invention																							
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☐	Box No. VI	Certain documents cited																							
☐	Box No. VII	Certain defects in the international application																							
☒	Box No. VIII	Certain observations on the international application																							
4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Date of issuance of this report 25 October 2016 (25.10.2016) Authorized officer Lingfei Bai e-mail: pt02.pct@wipo.int
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PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:
BALLARD SPAHR LLP

999 PEACHTREE STREET SUITE 1000 ATLANTA GA
30309 USA

Date of mailing
(day/month/year) **24 July 2015 (24.07.2015)**

Applicant's or agent's file reference
36362.0150P1

FOR FURTHER ACTION

See paragraph 2 below

International application No.
PCT/US2015/026907

International filing date (day/month/year)
21 April 2015 (21.04.2015)

Priority date(day/month/year)
21 April 2014 (21.04.2014)

International Patent Classification (IPC) or both national classification and IPC
E21B 10/02(2006.01)i, E21B 49/02(2006.01)i

Applicant
LONGYEAR TM, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR
International Application Division
Korean Intellectual Property Office
189 Cheongsu-ro, Seo-gu, Daejeon
Metropolitan City, 302-701, Republic of Korea
Facsimile No. +82-42-472-7140

Date of completion of this opinion

24 July 2015 (24.07.2015)

Authorized officer

HWANG, Chan Yoon

Telephone No. +82-42-481-3347



**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2015/026907

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :
- ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
- a. ☐ forming part of the international application as filed:
 - ☐ in the form of an Annex C/ST.25 text file.
 - ☐ on paper or in the form of an image file.
 - b. ☐ furnished together with the international application under PCT Rule 13ter.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
 - ☐ in the form of an Annex C/ST.25 text file (Rule 13ter.1(a)).
 - ☐ on paper or in the form of an image file (Rule 13ter.1(b) and Administrative Instructions, Section 713).
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2015/026907

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-33	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	5-6,9-16,18-27	YES
	Claims	1-4,7-8,17,28-33	NO
Industrial applicability (IA)	Claims	1-33	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: WO 2008-113127 A1 (2IC AUSTRALIA PTY LTD. et al.) 25 September 2008

D2: WO 2014-053012 A1 (MINNOVARE PTY LTD.) 10 April 2014

D3: WO 2007-104103 A1 (2IC AUSTRALIA PTY LTD. et al.) 20 September 2007

D4: US 2012-0145461 A1 (CRAVATTE, PHILLIPE) 14 June 2012

D5: US 6732818 B2 (GREGORY, FRANK) 11 May 2004

1. Novelty and Inventive Step

1.1 Independent Claim 1

D1, which is considered to be the closest prior art to the subject matter of claim 1, discloses an inner barrel assembly (11) comprising: a core orientation tool (10) including a body (22) and coupled to a core tube cap (18) and a backend assembly (14); an electronic core orientation device (20) housed within the body (22) and configured, upon a trigger signal, to log a core orientation of a core sample at least shortly before and during a core breaking action, the device (20) comprising multiple sensors; and a transceiver (28) configured to receive or send the orientation data (see page 11, line 30 - page 12, line 28 and figures 1-2). Claim 1 differs from D1 in that a core barrel head assembly comprises a power source in operable communication with at least one electronic instrument, wherein the power source is mounted therein an interior cavity. However, this feature comes within the scope of the customary practice followed by a person skilled in the art. Accordingly, claim 1 would have been obvious over D1. Therefore, claim 1 does not involve an inventive step under PCT Article 33(3).

Continued on Supplemental Box

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2015/026907

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claim 18 refers to itself and does not clearly define the matter for which protection is sought (PCT Article 6).
(Note: This written opinion has been established on the assumption that claim 18 is dependent on claim 17.)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of : Box No. V

1.2 Dependent Claims 2-33

The additional feature of claim 2, characterized in that an elongate tube body has a threaded proximal end for coupling to a wire line retrieval portion of a head assembly, would be easily conceived from the disclosure of D1 considering that the core tube cap (18) and the backend assembly (14) have a threaded proximal end (see figure 2). Accordingly, claim 2 would have been obvious over D1. Therefore, claim 2 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 3 is identical to the feature of D1 in that the body (22) has a cavity enclosing a gyroscope (34) (see page 16, lines 12-22 and figure 2). Accordingly, claim 3 would have been obvious over D1. Therefore, claim 3 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 4 is identical to the feature of D1 in that the body (22) has another cavity enclosing the electronic core orientation device (20) (see page 11, lines 30-33 and figure 2). Accordingly, claim 4 would have been obvious over D1. Therefore, claim 4 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 5, characterized in that a port is defined proximate to a base portion of the sealed interior cavity that extends from an exterior surface of the elongate tube body into fluid communication with a first interior cavity, is not disclosed in any of the prior art documents, nor is it obvious to a person skilled in the art by the documents. Therefore, claim 5 is novel and involves an inventive step under PCT Article 33(2) and (3).

Claim 6 is dependent on claim 5. Therefore, claim 6 meets the requirements of PCT Article 33(2) and (3).

The additional feature of claim 7 is identical to the feature of D1 in that the body (22) has another cavity enclosing the electronic core orientation device (20), the electronic core orientation device comprising the multiple sensors and the transceiver (28) (see page 11, line 30 - page 12, line 28 and figure 2). Accordingly, claim 7 would have been obvious over D1. Therefore, claim 7 does not involve an inventive step under PCT Article 33(3).

Continued on The Next Page

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of : Previous Page

The additional feature of claim 8, characterized in that the sealed interior cavity is sized and shaped to hermetically enclose the at least one electronic instrument and the power source, comes within the scope of the customary practice followed by a person skilled in the art. Accordingly, claim 8 would have been obvious over D1. Therefore, claim 8 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 9, concerning a plurality of windows defined in the elongate tube body that extend from the exterior surface of the elongate tube body into optical communication with the sealed interior cavity proximate a closed proximal end of the sealed interior cavity, is not disclosed in any of the prior art documents, nor is it obvious to a person skilled in the art by the documents. Therefore, claim 9 is novel and involves an inventive step under PCT Article 33(2) and (3).

Claims 10-16 are directly or indirectly dependent on claim 9. Therefore, claims 10-16 meet the requirements of PCT Article 33(2) and (3).

The additional feature of claim 17 is identical to the feature of D1 in that the body (22) extends distally to the threaded proximal end of the core tube cap (18) (see figure 2). Accordingly, claim 17 would have been obvious over D1. Therefore, claim 17 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 18, concerning a seal coupler that is configured to be sealingly received in the open threaded distal end of the elongate tube body, is not disclosed in any of the prior art documents, nor is it obvious to a person skilled in the art by the documents. Therefore, claim 18 is novel and involves an inventive step under PCT Article 33(2) and (3).

(Note: This written opinion has been established on the assumption that claim 18 is dependent on claim 17.)

Claims 19-27 are directly or indirectly dependent on claim 18. Therefore, claims 19-27 meet the requirements of PCT Article 33(2) and (3).

Continued on The Next Page

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of : Previous Page

The additional feature of claim 28, characterized in that an exterior surface of the elongate tube body defines a plurality of female planar stops proximate the mid body portion, is merely a design change of the body (22) of the core orientation tool (10) in D1 (see page 11, lines 30-33 and figure 2). Accordingly, claim 28 would have been obvious over D1. Therefore, claim 28 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 29 is identical to the feature of D1 in that the trigger signal may be provided when cessation of drilling is detected (see page 14, lines 7-21). Accordingly, claim 29 would have been obvious over D1. Therefore, claim 29 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 30 is identical to the feature of D1 in that the trigger signal may be provided when cessation of drilling is detected (see page 14, lines 7-21). Accordingly, claim 30 would have been obvious over D1. Therefore, claim 30 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 31 is identical to the feature of D1 in that the trigger signal may be provided when cessation of drilling is detected (see page 14, lines 7-21). Accordingly, claim 31 would have been obvious over D1. Therefore, claim 31 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 32, characterized in that at least one electronic instrument is programmed not to obtain orientation data when the at least one electronic instrument determines that the core barrel head assembly is in motion while descending down or ascending up the hole and during drilling, would be easily conceived from the disclosure of D1 considering that the trigger signal may be provided when cessation of drilling is detected (see page 14, lines 7-21). Accordingly, claim 32 would have been obvious over D1. Therefore, claim 32 does not involve an inventive step under PCT Article 33(3).

The additional feature of claim 33 is identical to the feature of D1 in that the orientation data by the electronic core orientation device (20) may occur for a predetermined period of time (see page 26, lines 5-18). Accordingly, claim 33 would have been obvious over D1. Therefore, claim 33 does not involve an inventive step under PCT Article 33(3).

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2015/026907

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2. Industrial Applicability

Claims 1-33 are industrially applicable under PCT Article 33(4).



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/017,334	06/25/2018		1820	36362.0150U3	21	1

CONFIRMATION NO. 6991

FILING RECEIPT



23859
Ballard Spahr LLP
SUITE 1000
999 PEACHTREE STREET
ATLANTA, GA 30309-3915

Date Mailed: 07/17/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

CHRISTOPHER L. DRENT, Burlington, CANADA;
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KHALED HEJLEH, Peppermint Grove, AUSTRALIA;

Applicant(s)

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GLOBALTECH CORPORATION PTY LTD, CANNING VALE, WA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 14/692,484 04/21/2015
which claims benefit of 61/982,052 04/21/2014

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 07/12/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/017,334**

Projected Publication Date: 10/25/2018

Non-Publication Request: No

Early Publication Request: No
Title

Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/017,334				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	660			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760			
TOTAL CLAIMS (37 CFR 1.16(j))	21	minus 20 = * 1				x 100 =	100			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1	minus 3 = *				x 460 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s)) If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							0.00			
							0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
			TOTAL			TOTAL	1820			
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	)	
	)	
DRENTH et al.	)	Art Unit: Unassigned
	)	
Application No.: Unassigned	)	Examiner: Unassigned
	)	
Filing Date: June 25, 2018	)	Confirmation No.: Unassigned
	)	
FOR: CORE BARREL HEAD ASSEMBLY	)	
WITH AN INTEGRATED SAMPLE	)	
ORIENTATION TOOL AND	)	
SYSTEM FOR USING SAME	)	

AUTHORIZATION TO TREAT REPLY REQUIRING EXTENSION OF TIME
AS INCORPORATING PETITION FOR EXTENSION OF TIME

Commissioner for Patents
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Ballard Spahr LLP
Customer Number 23859

Commissioner:

Pursuant to 37 C.F.R. §1.136(a)(3), the Commissioner is hereby requested and authorized to treat any concurrent or future reply in the above-identified application, requiring a petition for an extension of time for its timely submission, as incorporating a petition for extension of time for the appropriate length of time.

The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 14-0629.

Respectfully submitted,

BALLARD SPAHR LLP

/Joseph P. Anderson, III/
Joseph P. Anderson, III
Registration No. 59,245

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(678) 420-9300 Phone
(678) 420-9301 Fax

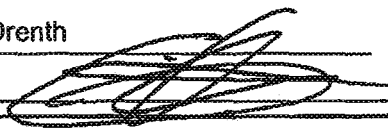
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	CORE BARREL HEAD ASSEMBLY WITH AN INTEGRATED SAMPLE ORIENTATION TOOL AND SYSTEM FOR USING SAME
As the below named inventor, I hereby declare that: This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT International application number <u>14/692,484</u> filed on <u>April 21, 2015</u> The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR	
Inventor: <u>Christopher L. Drenth</u> Date (Optional): <u>11/13, 2015</u>	
Signature: 	
Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

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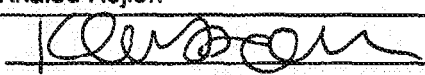
Title of Invention	CORE BARREL HEAD ASSEMBLY WITH AN INTEGRATED SAMPLE ORIENTATION TOOL AND SYSTEM FOR USING SAME
As the below named inventor, I hereby declare that: This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT international application number <u>14/692,484</u> filed on <u>April 21, 2015</u> The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. LEGAL NAME OF INVENTOR Inventor: <u>Gordon Stewart</u> Date (Optional): <u>10/7/15</u> Signature: <u><i>Gordon Stewart</i></u> Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

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**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention	CORE BARREL HEAD ASSEMBLY WITH AN INTEGRATED SAMPLE ORIENTATION TOOL AND SYSTEM FOR USING SAME
As the below named inventor, I hereby declare that: This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT international application number <u>14/692,484</u> filed on <u>April 21, 2015</u> The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. LEGAL NAME OF INVENTOR Inventor: <u>Khaled Hejleh</u> Date (Optional): _____ Signature:  Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 118 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to be used by the USPTO to process an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	36362.0150U3
		Application Number	
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--------------------------	---

Inventor Information:

Inventor	1				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	CHRISTOPHER	L.	DRENTH		
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Burlington	Country of Residence ⁱ	CA		

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City	Burlington	State/Province	ON		
Postal Code	L7P 4V2	Country ⁱ	CA		

Inventor	2				Remove
Legal Name					
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	GORDON		STEWART		
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Claremont	Country of Residence ⁱ	AU		

Mailing Address of Inventor:

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Address 2					
City	Claremont	State/Province			
Postal Code	6010	Country ⁱ	AU		

Inventor	3				Remove
Legal Name					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	36362.0150U3
		Application Number	
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		

Prefix	Given Name	Middle Name	Family Name	Suffix
	KHALED		HEJLEH	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Peppermint Grove		Country of Residence ⁱ	AU

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Address 2				
City	Peppermint Grove	State/Province		
Postal Code	6011	Country ⁱ	AU	
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add				

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
☐ An Address is being provided for the correspondence information of this application.			
Customer Number	23859		
Email Address	uspatentmail@ballardspahr.com	Add Email	Remove Email

Application Information:

Title of the Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		
Attorney Docket Number	36362.0150U3	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country ⁱ

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	36362.0150U3
		Application Number	
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.			
Please Select One:	☒ Customer Number	US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	23859		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78. When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	14692484	2015-04-21
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14692484	Claims benefit of provisional	61982052	2014-04-21
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	36362.0150U3
		Application Number	
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	36362.0150U3
		Application Number	
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	36362.0150U3
		Application Number	
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant	1	Remove	
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
		Clear	
☒ Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor	
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	LONGYEAR TM, INC.		
Mailing Address Information For Applicant:			
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Address 2			
City	SALT LAKE CITY	State/Province	UT
Country	US	Postal Code	84119
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	36362.0150U3
		Application Number	
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		

Applicant	2			Remove	
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.					
Clear					
☒ Assignee		Legal Representative under 35 U.S.C. 117		Joint Inventor	
Person to whom the inventor is obligated to assign.			Person who shows sufficient proprietary interest		
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:					
Name of the Deceased or Legally Incapacitated Inventor:					
If the Applicant is an Organization check here. ☒					
Organization Name		GLOBALTECH CORPORATION PTY LTD			
Mailing Address Information For Applicant:					
Address 1		ABN 18 087 281 418 OF 1/48			
Address 2		VINNICOMBE DRIVE			
City		CANNING VALE	State/Province		
Country	WA	Postal Code		6155	
Phone Number			Fax Number		
Email Address					

Additional Applicant Data may be generated within this form by selecting the Add button.

[Add](#)

Applicant	3			Remove	
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.					
Clear					
☐ Assignee		Legal Representative under 35 U.S.C. 117		Joint Inventor	
Person to whom the inventor is obligated to assign.			Person who shows sufficient proprietary interest		
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:					
Name of the Deceased or Legally Incapacitated Inventor:					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	36362.0150U3
		Application Number	
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		

If the Applicant is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Applicant:

Address 1				
Address 2				
City		State/Province		
Country		Postal Code		
Phone Number		Fax Number		
Email Address				

Additional Applicant Data may be generated within this form by selecting the Add button.

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Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee	1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	36362.0150U3
		Application Number	
Title of Invention	Core Barrel Head Assembly With An Integrated Sample Orientation Tool And System For Using Same		

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country ⁱ		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is **not** checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Joseph P. Anderson, III/		Date (YYYY-MM-DD)	2018-06-25
First Name	Joseph	Last Name	Anderson, III	Registration Number
				59245

Additional Signature may be generated within this form by selecting the Add button.

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**CORE BARREL HEAD ASSEMBLY WITH AN INTEGRATED SAMPLE
ORIENTATION TOOL AND SYSTEM FOR USING SAME**

CROSS REFERENCE TO RELATED PATENT APPLICATION

[0001] This application is a continuation of U.S. Patent Application No. 14/692,484, filed on April 21, 2015, which claims priority to U.S. Provisional Application No. 61/982,052, filed on April 21, 2014. Each of these applications is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates to down hole surveying in drilling operations. More particularly, to a core barrel assembly having at least one electronic instrument that is configured for use in a core sample down hole surveying and sample orientation system. In one example, the at least one electronic instrument is configured to provide an indication of the orientation of a core sample relative to a body of material from which the core has been extracted, and also to a method of core sample orientation identification.

BACKGROUND

[0003] Conventionally, core samples are obtained through the use of core drilling systems that comprise outer and inner tube assemblies. In operation, a cutting head is attached to the outer tube assembly so that rotational torque applied to the outer tube assembly can be transmitted to the cutting head. A core is generated during the drilling operation, with the core progressively extending along the elongate axis of the inner tube assembly as drilling progresses. Typically, when a core sample is acquired, the core within the inner tube assembly is fractured and the inner tube assembly and the fractured core sample contained therein are then retrieved from within the drill hole, typically by way of a retrieval cable lowered down the drill hole. Once the inner tube assembly has been brought to ground surface, the core sample can be removed and subjected to the desired analysis.

[0004] It is desirable for analysis purposes to have an indication of the orientation of the core sample relative to the ground from which it was extracted. This is

complicated in that it is common to drill at an angle relative to the vertical. For efficiency and accuracy of the mineralogical record, it is desirable to determine the orientation and survey position of each core's position underground before being drilled out and extracted. Such orientation and survey positions allow for the subsequent production of a three dimensional map of underground mineral/rock content.

[0005] One common way of obtaining an indication of the orientation of a core sample is through use of an orientation spear comprising a marker (such as a crayon) projecting from one end of a thin steel shank, the other end of which is attached to a wire line. The orientation spear is lowered down the drill hole, prior to the inner tube assembly being introduced. The marker on the orientation spear strikes the facing surface of material from which the core is to be generated, leaving a mark thereon. Because of gravity, the mark is on the lower side of the drill hole. The inner tube assembly is then introduced into the outer tube assembly in the drill hole. As drilling proceeds, a core sample is generated within the inner tube assembly. The core sample so generated carries the mark which was previously applied. Upon completion of the core drilling run and retrieval of the core sample, the mark provides an indication of the orientation of the core sample at the time it was in the ground.

[0006] Other conventional technologies use core orientation units attached to core inner tubes and back-end assemblies to determine the correct orientation of the drilled out core sample after a preferred predetermined drilling distance intervals during drilling. These core orientation units typically measure rotational direction of the core sample before extraction. On retrieval at the surface of the hole, the rotational direction can be determined by electronic means and the upper or lower side of the core material physically 'marked' for later identification by geologists.

[0007] Coupled with the core orientation system, a survey instrument is conventionally used. In this technique, at periodic depths, the survey instrument is lowered down the drill hole to determine azimuth (angular measurement relative to a reference point or direction), dip (or inclination) and any other required survey parameters. These periodic depth survey readings are used to approximate the drill-path at different depths. Together with the rotational position of the extracted core (from

the core orientation device), the three dimensional subsurface material content map can be determined.

[0008] It has been found desirable to provide an improved core barrel assembly having an integrated sample orientation subassembly and method for using same that is configured for use in a core sample down hole surveying and sample orientation that minimizes the need to add additional drill string elements, which allows for increased efficiency and speed of drilling.

SUMMARY

[0009] In one aspect, the present invention provides a core barrel head assembly having an elongate tube body that defines a selectively sealed interior cavity. The core barrel head assembly can have at least one electronic instrument positioned in the interior cavity that is configured to obtain core orientation data of a core sample and a power source positioned in the interior cavity and in electrical communication with the at least one electronic instrument. The core barrel head assembly can also have a communication means that is configured to receive and/or transmit orientation data for use in a core sample down hole surveying and/or sample orientation system. The derived core orientation data provides an indication of the orientation of the core sample relative to a body of material from which the core has been extracted, and also to a method of using same.

[0010] The core barrel head assembly is configured for connection to tube portions of a drill string via respective connection means. In another aspect, the at least one electronic instrument of the core barrel head assembly can be mounted, for example and without limitation, within the interior cavity defined the body, within an interior cavity that is defined therein a side wall of the body of the core barrel head assembly, or potted or in sealed contact with a portion of a side wall of the core barrel assembly (on either an exterior surface or an interior surface of a cavity defined therein the body). As one skilled in the art will contemplate, the core barrel head assembly can comprise at least one electronic instrument that is configured to obtain orientation data, an electrically coupled power source and communication means to receive and/or transmit orientation data.

[0011] In another aspect, the communication means can comprise a wireless communication means that is configured to wirelessly receive and/or transmit survey data. Optionally, the communication means can be configured to communicate one way or two ways with each other, when drilling has ceased or during drilling.

[0012] In one aspect, the at least one electronic instrument of the core barrel head assembly advantageously enables obtaining drill hole survey readings without the need to insert unwieldy extension drill rods and/or a survey probe to measure azimuth and inclination/dip of the drill hole path. This results in a reduction of equipment handling and usage of equipment, a reduction of operations by not needing to periodically withdraw the drill bit a certain distance in order to advance a survey probe ahead of, and therefore distanced from, the drill bit, with a resultant increase in operational efficiency.

[0013] Another aspect of the present invention provides a method of conducting a down hole survey of drilling, the method including: a) drilling the core from a subsurface body of material; b) recording data relating to orientation of the core to be retrieved, the data recorded using the at least one electronic instrument of the core barrel head assembly, c) separating the core from the subsurface body, and d) obtaining an indication of the orientation of the core based on the recorded core orientation data obtained before the core was separated from the subsurface body.

[0014] Optionally, the method can comprise: determining that drilling has ceased for a period of time, using the at least one electronic instrument of the core barrel head assembly to record data relating to orientation of the core to be retrieved, separating the core from the subsurface body, retrieving the core to the surface, and obtaining an indication of the orientation of the core based on the recorded core orientation data obtained once the drilling had ceased and before the core was separated from the subsurface body.

[0015] Advantages are that there is more time available for drilling due to less time required for surveying and manipulating additional pieces of equipment and mechanical extensions during the survey process.

BRIEF DESCRIPTION OF THE FIGURES

- [0016]** Figure 1 shows a perspective view of a core barrel head assembly being operatively coupled to a head assembly.
- [0017]** Figure 2 shows a longitudinal cross-sectional view of Figure 1.
- [0018]** Figure 3 shows an expanded view of a portion of Figure 2, showing the core barrel head assembly.
- [0019]** Figure 4 shows a perspective exploded view of the core barrel head assembly of Figure 1.
- [0020]** Figure 5 shows a longitudinal cross-sectional view of the core barrel head assembly, showing an at least one electronic instrument and an electrically coupled power source disposed therein an interior cavity of a body of the core barrel head assembly.
- [0021]** Figure 6 shows a longitudinal cross-sectional view of another aspect of the core barrel head assembly, showing an at least one electronic instrument and an electrically coupled power source disposed therein an interior cavity of a body of the core barrel head assembly.
- [0022]** Figure 7 shows a longitudinal cross-sectional view of the body of the core barrel head assembly.
- [0023]** Figure 8 shows a longitudinal cross-sectional view of a core barrel head assembly being operatively coupled to a head assembly.
- [0024]** Figure 9 shows a schematic view of an exemplary at least one electronic instrument.
- [0025]** Figure 10 shows a schematic view of an exemplary at least one electronic instrument and an electrically coupled power source for disposition therein an interior cavity of a body of the core barrel head assembly.
- [0026]** Figure 11 shows an exemplary high level flowchart relating to a method of using the present invention.
- [0027]** Figure 12 shows an exemplary flowchart relating to an alternative embodiment of a method of using the present invention.
- [0028]** Figure 13 shows an exemplary flowchart relating to an alternative embodiment of a method of using the present invention.

[0029] Figure 14 shows an exemplary prior art hand held device for wirelessly interrogating the core barrel head assembly of the present invention.

DETAILED DESCRIPTION

[0030] The present invention can be understood more readily by reference to the following detailed description, examples, drawings, and claims, and their previous and following description. However, before the present devices, systems, and/or methods are disclosed and described, it is to be understood that this invention is not limited to the specific devices, systems, and/or methods disclosed unless otherwise specified, as such can, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular aspects only and is not intended to be limiting.

[0031] The following description of the invention is provided as an enabling teaching of the invention in its best, currently known embodiment. To this end, those skilled in the relevant art will recognize and appreciate that many changes can be made to the various aspects of the invention described herein, while still obtaining the beneficial results of the present invention. It will also be apparent that some of the desired benefits of the present invention can be obtained by selecting some of the features of the present invention without utilizing other features. Accordingly, those who work in the art will recognize that many modifications and adaptations to the present invention are possible and can even be desirable in certain circumstances and are a part of the present invention. Thus, the following description is provided as illustrative of the principles of the present invention and not in limitation thereof.

[0032] As used throughout, the singular forms “a,” “an” and “the” include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to “a port” can include two or more such ports unless the context indicates otherwise.

[0033] Ranges can be expressed herein as from “about” one particular value, and/or to “about” another particular value. When such a range is expressed, another aspect includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by use of the antecedent “about,” it will be understood that the particular value forms another aspect. It will be

further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint.

[0034] As used herein, the terms “optional” or “optionally” mean that the subsequently described event or circumstance may or may not occur, and that the description includes instances where said event or circumstance occurs and instances where it does not.

[0035] The word “or” as used herein means any one member of a particular list and also includes any combination of members of that list.

[0036] As will be appreciated by one skilled in the art, the methods and systems may take the form of an entirely hardware embodiment, an entirely software embodiment, or an embodiment combining software and hardware aspects. Furthermore, the methods and systems may take the form of a computer program product on a computer-readable storage medium having computer-readable program instructions (e.g., computer software) embodied in the storage medium. More particularly, the present methods and systems may take the form of web-implemented computer software. Any suitable computer-readable storage medium may be utilized including, without limitation, hard disks, CD-ROMs, optical storage devices, magnetic storage devices, or solid-state electronic storage devices.

[0037] Embodiments of the methods and systems are described below with reference to block diagrams and flowchart illustrations of methods, systems, apparatuses and computer program products. It will be understood that each block of the block diagrams and flowchart illustrations, and combinations of blocks in the block diagrams and flowchart illustrations, respectively, can be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus create a means for implementing the functions specified in the flowchart block or blocks.

[0038] These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing

apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including computer-readable instructions for implementing the function specified in the flowchart block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions that execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

[0039] Accordingly, blocks of the block diagrams and flowchart illustrations support combinations of means for performing the specified functions, combinations of steps for performing the specified functions and program instruction means for performing the specified functions. It will also be understood that each block of the block diagrams and flowchart illustrations, and combinations of blocks in the block diagrams and flowchart illustrations, can be implemented by special purpose hardware-based computer systems that perform the specified functions or steps, or combinations of special purpose hardware and computer instructions.

[0040] In one aspect, a drill assembly for drilling into a subsurface body of material can comprise a drill string 10 comprising a drill bit, an outer tube formed of linearly connected tube sections, and an inner tube for receiving the core drilled from the subsurface body. In one aspect, the core barrel head assembly 30 is integrated into the drill string 10 to form a portion of the drill string, such as shown in Figure 1, where the core barrel head assembly is operably coupled to a conventional head assembly 20.

[0041] The core barrel head assembly is configured for connection to tube portions of a drill string via respective connection means. In another aspect, the at least one electronic instrument of the core barrel head assembly can be mounted, for example and without limitation, within the interior cavity defined the body, within an interior cavity that is defined therein a side wall of the body of the core barrel head assembly, or potted or in sealed contact with a portion of a side wall of the core barrel assembly (on either an exterior surface or an interior surface of a cavity defined therein the body). As

one skilled in the art will contemplate, the core barrel head assembly can comprise at least one electronic instrument that is configured to obtain orientation data, an electrically coupled power source and communication means to receive and/or transmit orientation data.

[0042] In one aspect, and referring to Figures 1-7, the core barrel head assembly 30 can comprise at least one electronic instrument 40 that is configured to obtain orientation data, a operatively electrically coupled power source 50 and communication means to receive and/or transmit orientation data. In one aspect, at least one electronic instrument 40 can comprise at least one digital and/or electro-mechanical sensors 42, and/or one or more physical data sensors 44 in a core orientation data recording tool that can be configured to determine the core orientation just prior to or after the core break, and, optionally, to detect the signal of the break of the core from the body of material. In various aspects, it is contemplated that the recorded data can optionally include “dip” angle and/or azimuth datum to increase the reliability of the core orientation results as described below.

[0043] In this aspect, the at least one digital and/or electro-mechanical sensor 42 in operative communication with the at least one electronic instrument 40 of the core barrel assembly can be configured to detect vibration and/or to detect tri-axial gravitation loading acting on the electronic instrument. In one exemplary aspect, once a desired vibration state is detected and/or a desired G-loading state is detected, drilling can cease and the core barrel head assembly can record data relating to the orientation of the core, such as, for example and without limitation, gravitational field strength and direction, and/or magnetic field strength and direction.

[0044] The core barrel head assembly 30 has a proximal end 32 that is operatively oriented toward the drill bit end of the drill string and an opposed distal end 34. As shown in Figures 1 and 5-6, the core barrel head assembly 30 has an elongate tube body 60 that is conventionally joined to a conventional wire line retrieval portion of a head assembly 10. Thus, the head assembly of the drill string is complete without the necessity for the use of an unwieldy extension tube as required in the prior art designs.

[0045] The threaded proximal end 62 of the elongate tube body 60 is in communication with a first interior cavity 64 that extends distally to a base portion 65. Proximate the base portion of the second interior cavity, a port 66 is defined that extends from the exterior surface of the elongate tube body into fluid communication with the first interior cavity. Optionally, in this aspect, it is contemplated that a grease fitting 68 can be mounted in the port 66 to allow for selective passage of grease or lubricant into communication with the first interior cavity and vice versa.

[0046] A second interior cavity 70 is defined therein the elongate tube body 60 that is spaced from and extends distally from the first interior cavity. The second interior cavity 70 can be sized to hermetically enclose at least one of the least one electronic instrument 40 that is configured to obtain orientation data, the power source 50 and the communication means to receive and/or transmit orientation data. In another aspect, the second interior cavity 70 can be sized to hermetically enclose the least one electronic instrument 40 that is configured to obtain orientation data and the power source 50. In one aspect, the at least one electronic instrument 40 can comprise the electronic instrument discussed above and schematically shown in Figures 8 and 9. The at least one electronic instrument 40 is operatively electrically coupled to the power source 50, which can comprise any conventional power source, such as, for example and without limitation, a battery, a rechargeable battery, and the like.

[0047] In one aspect, as shown, a plurality of windows 74 can be defined in the elongate tube body that extend from the exterior surface 61 of the elongate tube body into the second interior chamber 70 proximate the closed proximal end 72 of the second interior chamber. In a further aspect, an orientation indicator module 80 can be provided that comprises a plurality of light emitters 82. The orientation indicator module 80 can be sized and shaped to sealingly close the second interior chamber from any intrusion of pressurized fluid into the second interior chamber 70 via the defined plurality of windows 74.

[0048] In another aspect, it is contemplated that the second interior cavity can comprise at least one orienting slot defined therein. In this aspect, the orientation indicator module can be oriented manually and the desired position can be maintained

to the at least one O-ring seal 84 described below. Optionally, in a further aspect, the orientation indicator module 82 is configured to orient or otherwise position a plurality of light emitters 88 so that each light emitter underlies one window.

[0049] In one aspect, the orientation indicator module 80 can further comprise a sealing means for preventing any pressurized fluid from entering the second interior cavity 70 from the defined windows 74. In one aspect, the sealing means can comprise at least one O-ring seal 84 that is mounted on an exterior portion of the orientation indicator module and that is configured to seal between the exterior portion of the orientation indicator module and a portion of the interior surface of the second interior cavity.

[0050] In one exemplary aspect, light from the plurality of light emitters 88 (e.g. LEDs, and the like) passes through or can be observed through the plurality of windows 74. Reference arrow A refers to the drill bit end direction, and reference arrow B refers to the head assembly direction. Further, as described above, the process of obtaining core orientation is made easier by only requiring two color lights, such as, for example and without limitation, green and red, to indicate one or other direction of rotation to establish correct core orientation prior to marking. The indicators form part of the sealed device and can be low power consumption LED lights.

[0051] Alternatively, flashing lights may be used, such as, for example and without limitation, a certain frequency or number of flashes for one direction and another frequency or number of flashes for the other direction of rotation. A steady light could be given when correct orientation is achieved. Thus, advantageously, when the core barrel head assembly 30 and the core sample are recovered from down the hole, the core barrel head assembly 30 need not be separated from the drill string in order to determine a required orientation of the core sample. Wireless communication to a remote device, such as a hand held device, to transfer data between the core barrel head assembly and the remote device, can also be effected by transmitting through the at least one aperture.

[0052] In another aspect, the second interior cavity 70 extends distally to the open distal end 73 of the elongate tube body 60. To further effect a hermetical enclosure of

the least one electronic instrument 40 that is configured to obtain orientation data, the power source 50 and, optionally, the communication means to receive and/or transmit orientation data, a seal coupler 90 can be provided that is configured to be sealingly received in the open threaded distal end 73 of the elongate tube body 60. As noted, a sealing means can be provided to prevent any pressurized fluid from entering the second interior cavity. In one aspect, the sealing means can comprise at least one O-ring seal 95 that is mounted on a portion of the seal coupler and that is configured to seal between a portion of the seal coupler and a portion of the interior surface of the open distal end of the elongate tube body.

[0053] In a further aspect, to further effect a hermetical seal of the second interior cavity and to provide fluid control for the wire line operation, a check valve assembly 100 is provided. In one aspect, the check valve assembly 100 comprises a coupled proximal end assembly and a distally tapered seat that defines an interior chamber 110 for operative receipt of a check ball 120.

[0054] In one aspect, the proximal end assembly 102 of the check valve assembly can define a female threaded coupling that is configured to be threadably coupled to the male threads defined on the exterior surface of the distal end 73 of the elongate tube body 60. As one skilled in the art will appreciate, as the proximal end assembly of the check valve assembly 100 is threadably coupled to the distal end 73 of the elongate tube body, the seal coupler 90 is driven into a sealed position therein the second interior cavity 70 to affect complete hermeticity.

[0055] Further, as one skilled in the art will appreciate, because the orientation indicator module 90 is sealingly disposed in the proximal end of the second interior chamber 70, the least one electronic instrument 40, the power source 50 and, optionally, the communication means to receive and/or transmit orientation data is disposed in operative contact with the orientation indicator module, and the seal coupler 90 is disposed in contact with the least one electronic instrument 40, the power source 50 and, optionally, the communication means to receive and/or transmit orientation data, as the proximal end assembly of the check valve assembly is threadably coupled to the distal 73 end of the elongate tube body, both the sealing means on the respective

orientation indicator module 80 and the seal coupler 90 are driven into a sealed position therein the second interior cavity to affect complete hermeticity of the second interior cavity.

[0056] In another aspect, the interior chamber 110 of the check valve assembly extends to a distal end 104 of the check valve assembly. In this aspect, at least one port 106 is provided that extends from the exterior surface of the check valve assembly and is in fluid communication with the interior chamber of the check valve assembly. In one aspect, the at least one port 106 can comprise a plurality of ports. In this aspect, it is contemplated that the plurality of ports can be angularly spaced an equal or an unequal number of degrees apart.

[0057] In this aspect, the interior chamber 110 can have a distally tapered seat 112 that is adapted to selectively receive the ball 120 that is sized to selectively block the distally tapered seat. One skilled in the art will appreciate that the interior chamber 110 of the check valve assembly 100 can be sized and shaped to allow the ball to selectively move axially between an open position, in which the ball is spaced proximally away from the surface of the tapered seat so that pressurized fluid can move through the distal end of the check valve assembly and subsequently through the interior chamber to exit out of the at least one port, and a closed position, in which the ball is pressurized against the surface of the tapered seat so that pressurized fluid cannot move through the check valve assembly.

[0058] In a further aspect, the exterior surface 61 of the elongate tube body 60 can define a plurality of female planar stops 67 proximate the mid-body portion. These female planar stops aid in grasping and selectively orienting the orientation of the core barrel head assembly 30. Optionally, additional female planar stops 69 can be defined proximate the indicator windows defined in the elongate tube body to aid in ease of selectively orienting the sample.

[0059] Referring now to Figure 8, an alternative embodiment of the core barrel head assembly 30 is shown that comprises at least one electronic instrument 40 that is configured to obtain orientation data, a operatively electrically coupled power source 50 and communication means to receive and/or transmit orientation data.

[0060] In this aspect the core barrel head assembly 130 has a proximal end 132 that is operatively oriented toward the drill bit end of the drill string and an opposed distal end 134. As shown in Figure 8, the core barrel head assembly 130 is conventionally joined to a conventional wire line retrieval portion of a head assembly 10. Thus, the head assembly of the drill string is complete without the necessity for the use of an unwieldy extension tube as required in the prior art designs.

[0061] The core barrel head assembly 130 has an elongate tube body 160 that is operably coupled to elongate hollow spindle 170 that is, in turn, operably coupled to a selectively open check valve assembly 180. The elongate tube body has a threaded proximal end 162 that defines an internal bushing mount 163. The open distal end 164 of the elongate tube body defines an internal shoulder 165 that is sized and shaped to receive at least one conventional cylindrical bearing 190.

[0062] A bushing 192 is mounted in the bushing mount and is sized and shaped to rotatably receive the proximal end 172 of the hollow spindle 170. As shown in the figures, a mid-portion of the hollow spindle is rotatably supported by the at least one bearing 190. In a further aspect, a nut 194 is coupled to a treaded portion 174 of the hollow spindle 170 adjacent to the proximal end of the hollow spindle 170.

[0063] The a portion of the interior wall 165 of the elongate tube body 160, a portion of the nut 194 and a portion of the exterior surface of the hollow spindle define a an interior cavity 166 into which a spring is mounted and the at least one electronic instrument 40 that is configured to obtain orientation data, a operatively electrically coupled power source 50 and communication means to receive and/or transmit orientation data are mounted. The least one electronic instrument 40 that is configured to obtain orientation data, a operatively electrically coupled power source 50 and communication means to receive and/or transmit orientation data can be integrated; potted or otherwise affixed to the elongate tube body within the interior cavity 166. As one skilled in the art will appreciate, as the hollow spindle turns, the elongate tube body will remain in the same position, *i.e.*, the elongate tube body does not turn when the hollow spindle is turned.

[0064] In an optional aspect, a port 167 is defined that extends from the exterior surface of the elongate tube body into fluid communication with the interior cavity. Optionally, in this aspect, it is contemplated that a grease fitting 168 can be mounted in the port 167 to allow for selective passage of grease or lubricant into communication with the interior cavity.

[0065] It is contemplated that the interior cavity 166 can be sized to hermetically enclose at least one of the least one electronic instrument 40 that is configured to obtain orientation data, the power source 50 and the communication means to receive and/or transmit orientation data. In another aspect, the interior cavity 166 can be sized to hermetically enclose the least one electronic instrument 40 that is configured to obtain orientation data and the power source 50. In one aspect, the at least one electronic instrument 40 can comprise the electronic instrument discussed above and schematically shown in Figures 9 and 10. The at least one electronic instrument 40 is operatively electrically coupled to the power source 50, which can comprise any conventional power source, such as, for example and without limitation, a battery, a rechargeable battery, and the like.

[0066] In a further aspect, to provide fluid control for the wire line operation, a selectively open check valve assembly 180 is provided. In one aspect, the check valve assembly 180 comprises a coupled end assembly 182 defining a proximally tapered seat 184 that defines an interior chamber 185 for operative receipt of a check ball 195.

[0067] In one aspect, the coupled end assembly 182 of the check valve assembly can define a female threaded coupling that is configured to be threadably coupled to the male threads defined on the exterior surface of the distal end 173 of the hollow spindle 170. Thus, as shown in the figures, the tapered seat 184 is operably coupled to the distal end 173 of the spindle 170 such that the hollow interior of the spindle 170 can be selectively placed in fluid communication with fluid governed by the check valve assembly 180.

[0068] As one skilled in the art will appreciate, the end assembly 182 of the check valve assembly defines at least one port 186 that extends from the exterior surface of the check valve assembly and is in fluid communication with the interior chamber of the

check valve assembly. In one aspect, the at least one port 186 can comprise a plurality of ports. In this aspect, it is contemplated that the plurality of ports can be angularly spaced an equal or an unequal number of degrees apart.

[0069] In this aspect, the interior chamber 185 can have a proximally tapered seat 184 that is adapted to selectively receive the ball 195 that is sized to selectively block the proximally tapered seat. One skilled in the art will appreciate that the interior chamber 185 of the check valve assembly 180 can be sized and shaped to allow the ball to selectively move axially between an open position, in which the ball is spaced proximally away from the surface of the tapered seat so that pressurized fluid can move out through the elongate spindle into the proximal end of the check valve assembly and subsequently through the interior chamber of the check valve assembly to exit out of the at least one port, and a closed position, in which the ball is pressurized against the surface of the tapered seat so that pressurized fluid cannot move through the check valve assembly to through the hollow spindle.

[0070] In operation, it is contemplated that, in one non-limiting example, the at least one electronic instrument 40 of the core barrel head assembly 30 does not take any orientation measurements while vibrations, such as from the drilling operation, are present. In this aspect, the combination of mechanical, electromechanical and/or electronic sensors and software algorithms programmed into the at least one electronic instrument of the core barrel head assembly are configured to determine that the core barrel head assembly is in motion while descending down the hole and during drilling and is therefore not yet needed to detect breaking of the core sample from the body of material. Similarly, in a further aspect, it is contemplated that the at least one electronic instrument of the core barrel head assembly can be configured to detect that the core barrel head assembly is ascending to the surface for core retrieval after core breaking and subsequently will not take any core orientation measurements during the ascending operation.

[0071] In one non-limiting example, in operation, when the driller is ready to break the core, the driller can selectively not rotate the drill string for a first predetermined delay time period that can range from between about 10 seconds to about 90 seconds.

During the delay time period, it is contemplated that an orientation and dip measurement can be taken during this non-rotation, *i.e.*, minimal vibration, period. Subsequently, after breaking the core, the driller can wait a second predetermined delay time period that can range from between about 60 seconds to about 120 seconds, or at least 90 seconds before initiating further rotation.

[0072] Optionally, it is contemplated that pressure created within the borehole by drilling mud and/or water, which may be pumped down the borehole from the surface can be detected by the at least one electronic instrument 42, which can comprise at least one pressure sensor. In various non-limiting examples, the at least one pressure sensor can be mounted on the drill string, such as on the inner and/or outer drill tube or on the drill bit or on the core barrel head assembly. The detected pressure, such as, for example and without limitation, pressure within the inner tube receiving the core, or pressure differential, such as, for example and without limitation, pressure differential between/across the inner and outer tubes, can be indicative of the inner tube being nearly or totally full of core material. This can occur before the core is separated from the subsurface body of material (such as by breaking the core from the body by a sharp pull back on the core) and hence can provide an indicator that the core is about to be broken.

[0073] Optionally, it is contemplated that the least one electronic instrument 40, which is configured to obtain orientation data, the power source 50 and the communication means to receive and/or transmit orientation data can be sized and shaped to be integrally mounted therein conventional wire line assemblies. In this aspect, the least one electronic instrument 40 that is configured to obtain orientation data, the power source 50 and the communication means to receive and/or transmit orientation data can be miniaturized and/or flexible to be received within defined cavities therein the conventional wire line assemblies and can be subsequently hermetically sealed, such as with, for example and without limitation, an epoxy, therein the defined cavities.

[0074] One skilled in the art will appreciate that the core barrel head assembly 30 does not need to be separated from the head assembly 20 in order to determine core sample orientation and/or to gather data recorded by the tool means that there is less

risk of equipment failure and drilling downtime, as well as reduced equipment handling time through not having to separate the sections in order to otherwise obtain core sample orientation. Known systems require an end-on interrogation of the tool. By providing a sealed apparatus and the facility to determine orientation of the core sample by observing the orientation indications through one or more windows 74 in the side of the elongate tube body 60, reliability and efficiency of core sample collection and orientating is improved. Consequently operational personnel risk injury, as well as additional downtime of the drilling operation. Without having to separate core barrel head assembly 30 from the head assembly, the orientation of the core sample can be determined and the gathered information retrieved with less drilling delay and risk of equipment damage/failure.

[0075] Further, unlike known systems, the core barrel head assembly 30 provides for the desired flow of pressurized fluid in the wire-line assemblies to conventionally operate the fluid control valves that are commonly used in wire-line operations. As noted, the check valve assembly 100 allows for the selective passage of fluid therethrough that assembly and to the exterior surface of the core barrel head assembly 30 and subsequently through the pressure relief valve to exit out of the first interior cavity of the elongate tube body.

[0076] In one aspect, the one or more pressure sensors 42 can be provided to detect pressure data, which can comprise pressure readings; changes in pressure and/or pressure differentials. The pressure data can be operative communication with the core barrel head assembly 30 and/or an operator at the surface. In one exemplary aspect, once a desired pressure value is detected, drilling can cease and the at least one electronic instrument 40 of the core barrel head assembly 30 can record data relating to the orientation of the core, such as gravitational field strength and direction, and/or magnetic field strength and direction.

[0077] In various aspects, it is contemplated that the recorded data can optionally include "dip" angle or azimuth datum to increase the reliability of the core orientation results. Conventionally, dip is the angle of the inner core tube drill assembly with respect to the horizontal plane and can be the angle above or below the horizontal

plane depending on drilling direction from above ground level or from underground drilling in any direction. This provides further confirmation that the progressive drilling of a hole follows a maximum progressive dip angle which may incrementally change as drilling progresses, but not to the extent which exceeds a dogleg severity, *i.e.*, a normalized estimate (e.g. degrees / 30 meters) of the overall curvature of an actual drill-hole path between two consecutive directional survey/orientation stations.

[0078] In operation, prior to obtaining an orientation and core sample, a remote external communication device can be set by an operator to a start time. The remote external communication device communicates with the at least one electronic instrument 40 of the core barrel head assembly 30 before it is tripped into the drill hole. Subsequently, after a predetermined timed interval has elapsed from the start time, the at least one electronic instrument 40 can be configured to begin normal operation to detect the signature of vibration indicating a core break.

[0079] Optionally, in another aspect, pressure changes or levels can be detected to indicate a pre-break condition or period, such as pressure of mud/water within the inner tube increasing due to the core filling or nearly filling the inner tube holding the core.

[0080] In one aspect, the at least one electronic instrument 40 of the core barrel head assembly 30 can be configured to not take any orientation measurements while vibrations, such as from the drilling operation, are present. In this aspect, the combination of mechanical, electromechanical and/or electronic sensors and software algorithms programmed into the at least one electronic instrument 40 of the core barrel head assembly 30 can be configured to determine that the core barrel head assembly is in motion while descending down the hole and during drilling and is therefore not yet needed to detect breaking of the core sample from the body of material. Similarly, in a further aspect, it is contemplated that the at least one electronic instrument 40 of the core barrel head assembly 30 can be configured to detect that the core barrel head assembly is ascending to the surface for core retrieval after core breaking and subsequently will not take any core orientation measurements during the ascending operation.

[0081] Optionally, dip angle can be included in determining orientation of the core. In one aspect, the dip angle of the drill hole can be used to determine whether or not to

use the obtained orientation data. For example, a valid core orientation sample can be determined from the previously discussed validation steps being acceptable and, additionally, from the dip angle of the drill hole also being within acceptable limits. In one aspect, the dip can be sampled as a reference prior to the first run of a new drill hole. This particular reference is called a setup function. In this aspect, the setup function can be selected on the remote communications device, which then communicates to the core barrel head assembly. For clarity, the core sample orientation subassembly does not orientation the core, rather, it records signals indicative of the orientation of the core to be retrieved. The core barrel head assembly can then be lowered down the hole or aligned to the angle of the drill rods in the case of no hole yet to be drilled. Once the core barrel head assembly is down to a desired position or to the end of the hole the user can "mark" the "shot," preferably via use of the remote communications device.

[0082] Subsequently, the core barrel head assembly is retrieved and the remote communications device can be used to communicate the dip (angle) of the drill hole to the communication means of the core barrel head assembly. Optionally, the dip of the end of the hole can be manually entered into the remote communications device and this communicated back to the core barrel head assembly.

[0083] In one aspect, a compliant datum is obtained when one or more signals indicative of the orientation of the core is/are obtained by the core orientation device during a period of no drilling vibration prior to detecting vibration from breaking the core and that being prior to a subsequent period of no drilling vibration. It is contemplated that one or more embodiments can utilize the final compliant datum instead of the first obtained compliant datum.

[0084] In one aspect, it is contemplated that the at least one electronic instrument 40 can comprise an LCD display 41 at one end. This can allow for setting up of the orientation system prior to deployment and to indicate visually alignment of the core sample when retrieved to the surface. The core barrel head assembly 30 can be connected to the core barrel head assembly which can be operably is connected to a sample tube for receiving a core sample. In one aspect, and as exemplarily shown in Figures 8 and 9, the at least one electronic instrument 40 can comprise at least one

vibration sensor, at least one accelerometer 43, a memory 45, a timer 47 and the aforementioned LCD display 41. Optionally, at least one electronic instrument 40 can further comprise one or more of at least one of a gravity sensor, magnetic field sensor, inclinometer, a direction measuring sensor, a gyro, and/or preferably a combination two or more of these devices.

[0085] In this aspect, the at least one electronic instrument 40 can be configured to record orientation data every few seconds during core sampling. The start time can be synchronized with actual time using a common stop watch. The operably coupled core barrel head assembly 30 and the core barrel head assembly can then be lowered into the drill string outer casing to commence core sampling. After drilling and capturing a core sample in the inner core sample tube, the operator, can stop the stop watch and retrieve the core sample tube back to the surface. At the surface, before removing the core sample from the inner tube, the operator can views the LCD display, if it is still working, which steps the operator through instructions to rotate the core tube until the core sample lower section is at the core tube lower end . The core sample is then marked and stored for future analysis.

[0086] Another aspect of the present invention provides a method of conducting a down hole survey of drilling, the method including: a) drilling the core from a subsurface body of material; b) recording data relating to orientation of the core to be retrieved, the data recorded using the at least one electronic instrument of the core barrel head assembly, c) separating the core from the subsurface body, and d) obtaining an indication of the orientation of the core based on the recorded core orientation data obtained before the core was separated from the subsurface body.

[0087] Optionally, the method can comprise: determining that drilling has ceased for a period of time, using the at least one electronic instrument of the core barrel head assembly to record data relating to orientation of the core to be retrieved, separating the core from the subsurface body, retrieving the core to the surface, and obtaining an indication of the orientation of the core based on the recorded core orientation data obtained once the drilling had ceased and before the core was separated from the subsurface body.

[0088] In one exemplary aspect, for the embodiment shown in the flowchart in Figure 11, the core orientation can be validated when the following events have occurred:

- a) Step 200: detecting no vibration above a threshold by the core barrel head assembly, or is detected to be below a threshold, for the first predetermined delay time period;
- b) Step 220: taking a core orientation measurement during the first predetermined delay time period;
- c) Step 230: detecting noise from breaking the core from the subsurface body after the first predetermined delay time period and before the second predetermined delay time period;
- d) Step 240: detecting no vibration above a threshold by the core barrel head assembly, or is detected to be below a threshold, for the second predetermined delay time period;
- e) Step 250: retaining the orientation measurement obtained in Step 220 only if Steps 200, 230 and 240 are present;
- f) Step 260: disregarding detected signals or to not detect vibration or lack of vibration if only if Steps 200, 230 and 240 are obtained. If the detected signals are disregarded, a vibration silence signal in Step 280 must be detected before the core is broken.

[0089] Optionally, as shown in Step 270, a dip measurement can be obtained during the period of no drilling prior to breaking the core (period Y), preferably if dip is within the set limits.

[0090] In one aspect, once the required core orientation is obtained, the core barrel head assembly may be shut down or turned to low power standby mode in Step 290 in preparation to be subsequently placed into an orientation mode. Once the core barrel head assembly 30 is retrieved to the surface in Step 300, an operator can set the core barrel head assembly to the orientation mode in Step 310. In one example, and not meant to be limiting, this can be done via the remote communication means for

communicating with the communication means of the core barrel head assembly in Step 320.

[0091] In a further aspect, it is contemplated that the core barrel head assembly can comprise an orientation indicator assembly that comprises one or more lights or other visual indicators, such as, for example and without limitation, one or more display panels to give an indication of orientation direction and required orientation for marking the core. In this aspect, once in orientation mode, visual indications, such as flashing of one or more LEDs, can indicate to the operator which direction to rotate the core to find the "correct down side" for marking. In this aspect, the "correct downside" is the part of the core that was lowermost prior to separating from the subsurface body.

[0092] Once the correct downside is identified in Step 330, the operator can again effect communication to the communication means of the core barrel head assembly via the remote communication device. In Step 340, and based on the orientation data recorded, the remote communication device can be configured to verify that the correct orientation was achieved. Subsequently, in Step 350, the operator can perform another orientation operation.

[0093] Optional and exemplary methods of using the present invention are shown in Figures 12 and 13. In one aspect, as shown in Figure 12, the at least one electronic instrument 40 of the core barrel head assembly 30 can be programmed to be used in a running mode, a hibernation mode and an orientating mode. In this aspect, the at least one electronic instrument 40 of the core barrel head assembly 30 is configured to actuate and take sequential provisional data readings (POD1, POD2, POD3, etc.) when the at least one electronic instrument senses that vibrations have stopped. These provisional data readings are taken as desired time intervals that can be between about 0.1 to about 1.0 seconds. In this aspect, the core barrel head assembly 30 is configured to actuate or power up when the at least one electronic instrument is taken out hibernation. Further, it is contemplated that the time clock starts operation whenever the at least one electronic instrument 40. For example, this could happen on the surface prior to insertion into the hole. The programming can also optionally disregard any acquired provisional data (POD1, POD2, POD3, etc.) if vibrations are sensed during any portion of the acquisition of the sequential provisional data readings.

In this case, the programming would automatically go to the step "Turn Off G-Sensor" in the running mode.

[0094] In one aspect, as shown in Figure 13, the at least one electronic instrument 40 of the core barrel head assembly 30 can be similarly programmed to be used in a running mode, a hibernation mode and an orientating mode. In this aspect, the at least one electronic instrument 40 of the core barrel head assembly 30 is configured to actuate in accord with a time interval scheme in which a signal is sent to the tri-axial g-sensors to take readings in accord with the predetermined time interval scheme.

[0095] In one aspect, it is contemplated that the core barrel head assembly 30 can be utilized in asynchronous time operation for core sampling. In this aspect, the data recording events taken by the core barrel head assembly 30 are not synchronized in time with the communication device. That is, the core barrel head assembly can be programmed to not commence timing from a reference time, and can optionally be programmed such that the at least one electronic instrument 40 of the core barrel head assembly 30 does not take samples (shots) at specific predetermined time intervals. For example, and not meant to be limiting, the at least one electronic instrument 40 of the core barrel head assembly 30 can be programmed to not take a three second sample every one minute with that one minute interval synchronized to the remote, which would therefore know when each sample is about to take place. In this aspect, the communication means or device is not synchronized to the core orientation unit, *i.e.* asynchronous operation, and therefore the communication device does not know if or when a sample is being taken. Thus, obtaining an indication of core sample orientation is simplified over known arrangements.

[0096] In one aspect, while the core barred head assembly is on the surface, the external communication device can signal to the at least one electronic instrument 40 to activate or come out of a standby mode prior to deployment down hole. Optionally, the at least one electronic instrument 40 can already be activated such that it is not necessary to have the at least one electronic instrument 40 switch on from a deactivated ('turned off') state.

[0097] Alternatively, the at least one electronic instrument 40 can be configured to activate and commence taking data samples after a predetermined period from

deployment from the surface or after elapse of an activation delay timer or other delay mechanism. For example, the data gathering device may be configured at the surface to only 'wake-up' from a standby mode to an activated mode after at least a predetermined period of time has elapsed or a counter has completed a predetermined count relating to a time period delay.

[0098] In one aspect, it is contemplated that the at least one electronic instrument 40 can be programmed to take measurements/record orientation data based on the time intervals and/or randomly generated time intervals. In this aspect, the programmed instructions to record data generated as a result of the regular or randomly generated time intervals can remain on-going while the at least one electronic instrument 40 activated. However, because at least one of the sensor(s) in the at least one electronic instrument 40 may be shut down/deactivated during sensed vibrations, no orientation data gets acquired during time period in which vibrations are sensed. When the vibrations stop, the sensors are turned on and the time intervals instructions would then resume execution as per the time regular or random intervals. In this aspect, orientation data is being measured/obtained per the time intervals being used, as preferably initiated at the beginning of the run or after a delay timer. But, data will not be recorded during the time intervals due to the fact that the sensor(s) will be off/deactivated, *e.g.* during a time period in which vibrations are sensed. In this aspect, when drilling ceases, which results in vibrations ceasing, data will be taken, and may preferably continue to be taken, in accordance with the time intervals scheme initiated at the surface, and preferably may always running in the background even when the sensor(s) is/are off or deactivated (*e.g.*, asleep).

[0099] In a further aspect, the at least one electronic instrument 40 can log and/or record orientation related data down hole at intervals (regular or randomly generated intervals within minimum and maximum interval time limits) and can also measures total lapsed survey time T.

[00100] In a further aspect, the at least one electronic instrument 40 can be started by an external communication device at the surface but a second, different, communication device can be used to 'mark' (to set) the point in time, *i.e.*, to commence the elapsed period of time t relating to breaking the core sample from the

underlying rock and thereby be used for identifying the data set recorded immediately before that break.

[00101] In one aspect, to compensate for taking regular or random time period orientation measurements, which uses up battery power as the at least one electronic instrument 40 advances down hole, a start delay can be provided. For example, when the external communication device at the surface is operated, e.g., turned on, an option to set a delay time in the at least one electronic instrument 40 may be displayed. For example, a delay in minutes between 0 to 99 minutes might be displayed. In this aspect, when the at least one electronic instrument 40 is started-up and the communication device communicates the delay period to the at least one electronic instrument 40, the timer in the at least one electronic instrument 40 will allow the delay period to elapse before any orientation measurements are recorded.

[00102] In one aspect, orientation data can be recorded while drilling is ceased and closest to time T_x , where T_x is preferably less than or equal to $T-t$, and where T is the time recorded by the at least one electronic instrument 40 (survey time) and t is the elapsed time recorded by the external communication device that was commenced once drilling ceased and the orientation data was recorded. In this exemplary aspect, it will be appreciated that the required recorded data may be at a time T_x greater than $T-t$, i.e., if the drilling remained ceased after commencing the elapsed time and separating (breaking) the core sample from the rock was delayed while the at least one electronic instrument 40 recorded orientation data. Thus, T_x can be greater than $T-t$ providing no drilling activity takes place after drilling ceases and before the core is broken from the underlying rock. In this aspect, in operation, when the core barrel head assembly 30 is retrieved back at the surface with the core sample), the external communication device interrogates the at least one electronic instrument 40 to identify the recorded core orientation data closest to $T-t$, i.e., the timer of the external communication device is not synchronised to the timer of the at least one electronic instrument 40, and both timers are not commenced at a reference time.

[00103] For example and without limitation, orientation data may be recorded by the at least one electronic instrument 40 at regular irregular intervals of time within a

known range of allowed time intervals, such as one or more of 10s, 15s, 20s or 30s intervals within a range of 1s to 1 minute. It is contemplated that the time intervals can be generated by a random (time) number generator operating within the minimum and maximum allowed range. Thus, the time intervals for obtaining orientation data may be repeated (e.g. 10s, 10s, 10s, 20s, 20s, 10s...). In this exemplary aspect, data recording events ('shots') are therefore not constantly taken on a set time period. However, it is contemplated that predetermined set time intervals may be used. That is, the at least one electronic instrument 40 may record orientation data every time interval, preferably up until the core is broken from the underlying rock, though recording may also continue afterwards.

[00104] In operation, the at least one electronic instrument 40 can be deployed down hole. Optionally, the at least one electronic instrument 40 can be started at the surface and its timer commence the survey time timing at the surface, or the timer can have a delay to save power until the at least one electronic instrument 40 is all or partway down the borehole. Subsequently, when the core sample has been captured sufficiently in the core tube, drilling ceases and during this period of non-drilling, the at least one electronic instrument 40 records orientation data relating to its own orientation in the borehole, and therefore, of the associated core sample that is captured in the core barrel head assembly 30, which cannot rotate unless the at least one electronic instrument 40 also rotates. Next, the core sample is broken away from the underlying rock and the core barrel head assembly 30 is retrieved to the surface.

[00105] In one aspect, an external communication device can record the elapsed time t by a user, *i.e.*, commencing the timer in the handheld external communication device at the surface. This is preferably either when drilling has ceased or immediately before breaking the core from the rock while drilling has ceased, or immediately after the core is broken. However, it will be appreciated that the elapsed time can be commenced after the core is broken away from the underlying rock because the at least one electronic instrument 40 can be programmed to identify the nearest recorded data older than the commencement of the elapsed time that occurred during no drilling. In this aspect, the external communication device retains a record of the elapsing time.

[00106] When the at least one electronic instrument 40 and core barrel head assembly 30 containing the core sample are retrieved to the surface, the user can interrogate the at least one electronic instrument 40. In this aspect, once the at least one electronic instrument 40 confirms receiving the interrogation command, the communication device can command halting of the survey time T (stopping the at least one electronic instrument 40's timer) and elapsed time t (stopping the external communication device's timer). In this aspect, the external communication device can instruct the at least one electronic instrument 40 to identify the recorded orientation data from immediately before or after the commencement of the elapsed period of time going back from the end of the survey time, *i.e.*, the at least one electronic instrument 40 has to 'look back' in time for the data recorded at or around the elapsed ago. In this aspect, the at least one electronic instrument 40 subtracts the elapsed time t from its survey time T to provide a time Tx associated with the required recorded data obtained when drilling was ceased.

[00107] In this aspect, once the correct recorded orientation data is identified in its memory, the at least one electronic instrument can go into orientation mode so that the core sample can be orientated and that orientation recorded. In one exemplary aspect, recording of orientation data by the at least one electronic instrument 40 is triggered on a time interval basis; this may be by the regular or random time intervals mentioned above. Recording the orientation data may only commence once the time delay has ended. For example, the timer within the at least one electronic instrument 40 may be running from deployment (or before) of the device into the borehole. However, the delay may prevent the device from recording orientation data until the delay has ended. Once the delay has ended, orientation data is recorded according to the prevailing time interval sequence, *i.e.*, randomly generated time intervals or regular time intervals.

[00108] Optionally, when vibration or other motion of the at least one electronic instrument 40 stops down hole sufficiently, the at least one electronic instrument 40 may resume recording orientation data according to the prevailing time interval regime or may switch to another time interval regime for sensing and recording orientation.

[00109] Optionally, the at least one electronic instrument 40 can be programmed to identify core orientation data recorded before breaking of the core sample but based on an elapsed time period commenced after breaking the core sample. The at least one electronic instrument 40 can be programmed to identify the recorded orientation data that that was recorded before commencement of the elapsed time. In a further aspect, the recorded data can be recorded after breaking of the core sample because of the time interval recording regime. In this aspect, if that data set was recorded while nothing was moving down hole (and has not moved since breaking the core), the data set can be trusted to be sufficiently accurate. It can be compared with one or more previous data sets, and if they concur, then can be deemed sufficiently accurate for orientation purposes. Only one of those data sets is needed and any other of them may be discarded or disregarded.

[00110] In a further aspect, it is contemplated that operation of the at least one electronic instrument 40 to commence recording orientation data can be initiated at the surface and device then deployed into the borehole. Commencement of recording orientation data can also be delayed, so as to save battery power by avoiding taking unnecessary or unusable orientation measurements whilst the device is progressing down the borehole. Orientation measurement immediately before or after breaking the core sample from the underlying rock is/are required. In one exemplary aspect, the at least one electronic instrument 40 can have a delay preventing recording of orientation data until the delay ends.

[00111] In another aspect, the at least one electronic instrument 40 can take orientation measurements periodically, such as at random or regular periods of time, and record one or more of those measurements. Preferably the at least one electronic instrument 40 can be in a sleep mode, change to a power-up (wake-up) mode and then take a measurement, and re-enter sleep each interval. In one aspect, if two or more consecutive orientation measurements are the same, the at least one electronic instrument 40 can ignore, not record or delete from memory unnecessary repeat measurements and only retain one of the repeat measurements, preferably being the first of the identical measurements. In this aspect, each recorded measurement of

orientation can be tagged or 'time stamped', preferably relative to the timer running in the at least one electronic instrument 40, *i.e.*, the recorded orientation data is given a time stamp Tx, where x is the particular time within the survey timeframe running in the device. Thus, Tx is the time since the survey time T commenced that that orientation data set was recorded. It is contemplated that Tx can be a real time or cumulative time since commencement of the survey time T. Thus, in this aspect, the at least one electronic instrument 40 can have a real time clock type timer or a 'start-stop' (counter or stopwatch) type timer. When drilling ceases and the core is to be broken from the underlying rock (because there is sufficient core sample in the core barrel), a 'mark' is taken, which commences an elapsed time t at the surface. In this aspect, it is contemplated that this mark can be taken before or after the break at either regular or irregular time intervals.

[00112] Referring now to Figure 14, an exemplary known hand held device 400 which receives wirelessly receives data or signals from the communication means of the core barrel head assembly. In this aspect, communication means of the core barrel head assembly comprises a transmitter which can use line of sight data transfer through the window, such as by infra-red data transfer, or a wireless radio transmission. The communication device 400 can store the signals or data received from the communication means of the core barrel head assembly. In one aspect, the communication device 400 can comprise a display 402, navigation buttons 404, 406, and a data accept confirmation button 408.

[00113] In one aspect, setting up of the core barrel head assembly 30 can be carried out before insertion into the drill hole. Data retrieval can be carried out by infrared communication between the communication means of the core barrel head assembly and a core orientation data receiver or communication device 400. In this aspect, after recovering the core sample inner tube back at the surface, and before removing the core sample from the tube, the operator can optionally remove the head assembly. The operator can use the remote communication device to obtain orientation data from the communication means of the core barrel head assembly using a line of sight wireless infrared communication between the remote device and communication means of the core barrel head assembly. However, it will be appreciated that communication of data

between the communication means of the core barrel head assembly and the communication device 400 can be by other wireless means, such as by radio transmission.

[00114] In this prior art aspect, the whole inner tube, core sample, and core barrel head assembly can be rotated as necessary to determine a required orientation of the core sample. The indicators on the proximal end of the core barrel head assembly indicate to the operator which direction, clockwise or anti-clockwise, to rotate the core sample. One color of indicator can be used to indicate clockwise rotation and another color can be used to indicate anticlockwise rotation is required. This is carried out until the core sample is oriented with its lower section at the lower end of the tube. The core sample is then marked for correct orientation and then used for analysis.

[00115] In one aspect, it is contemplated that the visual and/or audible orientation indicators, under certain site and/or environmental conditions, may not be sufficiently visible or audible. Thus, an additional or alternative means and/or method may be utilized to ensure that the core sample has been correctly oriented. In this embodiment, the exterior surface 61 of the body of the core barrel head assembly 30 can have angular degree marks that optionally are scribed/ etched, machined, molded or otherwise provided, such as by printing or painting, on the exterior surface 61. For example, dashes can be equally spaced around the outside parameter represent one or more angular degrees of the full circle or perimeter. Further scribing of a number every five dashes starting with the number 0 then 5, 10, 15 etc. until 355.

[00116] When the core is retrieved and the communication means of the core barrel head assembly communicates with the hand held communicator 400, additional information can be transmitted from the core barrel head assembly to the communicator 400, such as a number between zero 0 and 359 (inclusive) denoting an angular degree of rotation of core barrel head assembly and the core sample. When the core is oriented during one or more embodiments of the method of the present invention, the numerical scribing the core barrel head assembly should be the same as the number transmitted, to the communicator 400, which re-confirms correct orientation. Thus, if the visual or audible means for indicating core orientation are not useful or available, then

the core can be oriented using the angular degree arrangement to match the transmitted number, and then can be audited using the communicator 400.

[00117] Embodiments of the present invention provide the advantage of a fully operating down hole core barrel head assembly without having to disconnect or disassemble any part of the tool/device from the inner tube and/or from the head assembly or any other part of the drilling assembly that the core barrel head assembly would need to be assembled within for its normal operation. Disconnecting or disassembling the core barrel head assembly from the head assembly and/or inner tube risks failure of seals at those connections and/or risks cross threading of the joining thread. Also, because those sections are threaded together with high force, it takes substantial manual force and large equipment to separate the sections. High surrounding pressure in the drill hole means that the connecting seals between sections function to prevent water and dirt from ingressing into and damaging the device.

[00118] Although several embodiments of the invention have been disclosed in the foregoing specification, it is understood by those skilled in the art that many modifications and other embodiments of the invention will come to mind to which the invention pertains, having the benefit of the teaching presented in the foregoing description and associated drawings. It is thus understood that the invention is not limited to the specific embodiments disclosed hereinabove, and that many modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although specific terms are employed herein, as well as in the claims which follow, they are used only in a generic and descriptive sense, and not for the purposes of limiting the described invention, nor the claims which follow.

What is claimed is:

1. A core barrel head assembly, comprising:

an elongate tube body defining a first interior cavity and a selectively sealed interior cavity spaced distally from the first interior cavity, wherein the elongate tube body has a threaded proximal end for coupling to a wire line retrieval portion of a head assembly, wherein the first interior cavity extends distally from the threaded proximal end to a base portion of the elongate tube body, and wherein the elongate tube body further defines a port positioned proximate the base portion and extending from the exterior surface of the elongate tube body into fluid communication with the first interior cavity;

at least one electronic instrument that is configured to obtain orientation data mounted therein the sealed interior cavity, wherein the at least one electronic instrument comprises at least one digital and/or electro-mechanical sensors in a core orientation data recording tool that can be configured to determine a core orientation of a sample core just prior to or after the core break;

a power source in operable communication with the at least one electronic instrument, wherein the power source is mounted therein the interior cavity; and

communication means to receive and/or transmit core orientation data,

wherein the sealed interior cavity is sized and shaped to hermetically enclose the at least one electronic instrument and the power source.

2. The core barrel head assembly of Claim 1, wherein a pressure fitting is mounted in the port to allow for selective passage of fluid to and from the exterior surface of the barrel head assembly into communication with the first interior cavity.

3. The core barrel head assembly of Claim 1, wherein the sealed interior cavity is sized and shaped to hermetically enclose the communication means to receive and/or transmit orientation data.

4. The core barrel head assembly of Claim 1, further comprising a plurality of windows defined in the elongate tube body that extend from the exterior surface of the

elongate tube body into optical communication with the sealed interior cavity proximate a closed proximal end of the sealed interior cavity.

5. The core barrel head assembly of Claim 4, further comprising an orientation indicator module comprising a plurality of light emitters.

6. The core barrel head assembly of Claim 5, wherein the orientation indicator module is sized and shaped to sealingly close the sealed interior cavity from any intrusion of pressurized fluid into the sealed interior cavity via the plurality of windows.

7. The core barrel head assembly of Claim 5, wherein the orientation indicator module is configured to orient or otherwise position the plurality of light emitters so that each light emitter underlies one window.

8. The core barrel head assembly of Claim 5, wherein the orientation indicator module further comprises at least one first O-ring seal for preventing any pressurized fluid from entering the sealed interior cavity from the plurality of windows defined in the elongate tube body, wherein the at least one first O-ring seal is mounted on an exterior portion of the orientation indicator module and is configured to seal between an exterior portion of the orientation indicator module and a portion of an interior surface of the sealed interior cavity.

9. The core barrel head assembly of Claim 1, wherein the sealed interior cavity extends distally to an open threaded distal end of the elongate tube body.

10. The core barrel head assembly of Claim 9, further comprising a seal coupler that is configured to be sealingly received in the open threaded distal end of the elongate tube body.

11. The core barrel head assembly of Claim 10, further comprising at least one second O-ring seal for preventing any pressurized fluid from entering the sealed interior cavity, wherein the at least one second O-ring seal is mounted on a portion of the seal coupler and is configured to seal between a portion of the seal coupler and a portion of an interior surface of the open distal end of the elongate tube body.

12. The core barrel head assembly of Claim 7, further comprising a check valve assembly configured to affect a hermetical seal of the sealed interior cavity and to provide fluid control for wire line operation.
13. The core barrel head assembly of Claim 12, wherein the check valve assembly comprises a coupled proximal end assembly and a distally tapered seat that defines an interior chamber for operative receipt of a check ball.
14. The core barrel head assembly of Claim 13, wherein the proximal end assembly defines a female threaded coupling that is configured to be threadably coupled to male threads defined on an exterior surface of a distal end of the elongate tube body.
15. The core barrel head assembly of Claim 13, wherein the interior chamber of the check valve assembly extends to a distal end of the check valve assembly, and wherein the check valve assembly further defines at least one port that extends from an exterior surface of the check valve assembly and is in fluid communication with the interior chamber of the check valve assembly.
16. The core barrel head assembly of Claim 15, wherein the interior chamber has a distally tapered seat that is adapted to selectively receive the check ball that is sized to selectively block the distally tapered seat.
17. The core barrel head assembly of Claim 16, wherein the interior chamber is sized and shaped to allow the check ball to selectively move axially between an open position, in which the check ball is spaced proximally away from the surface of the tapered seat so that pressurized fluid can move through the distal end of the check valve assembly and subsequently through the interior chamber to exit out of the at least one port, and a closed position, in which the check ball is pressurized against the surface of the tapered seat so that pressurized fluid cannot move through the check valve assembly.
18. The core barrel head assembly of Claim 1, wherein an exterior surface of the elongate tube body defines a plurality of female planar stops proximate the mid-body portion.

19. The core barrel head assembly of Claim 1, wherein the at least one electronic instrument is programmed to obtain orientation data when the at least one electronic instrument senses no relative movement of the at least one electronic instrument.

20. The core barrel head assembly of Claim 19, wherein the at least one electronic instrument is programmed to obtain orientation data when the at least one electronic instrument senses no vibrations, and wherein the at least one electronic instrument is programmed to not obtain orientation data when the at least one electronic instrument determines that the core barrel head assembly is in motion while descending down or ascending up the hole and during drilling.

21. The core barrel head assembly of Claim 1, wherein the at least one electronic instrument is programmed to obtain orientation data based on a predetermined time interval scheme.

ABSTRACT

A core barrel head assembly having at least one electronic instrument that is configured to obtain orientation data; a power source; and a communication means to receive and/or transmit orientation data for use in a core sample down hole surveying and sample orientation system that is configured to provide an indication of the orientation of a core sample relative to a body of material from which the core has been extracted, and also to a method of core sample orientation identification..

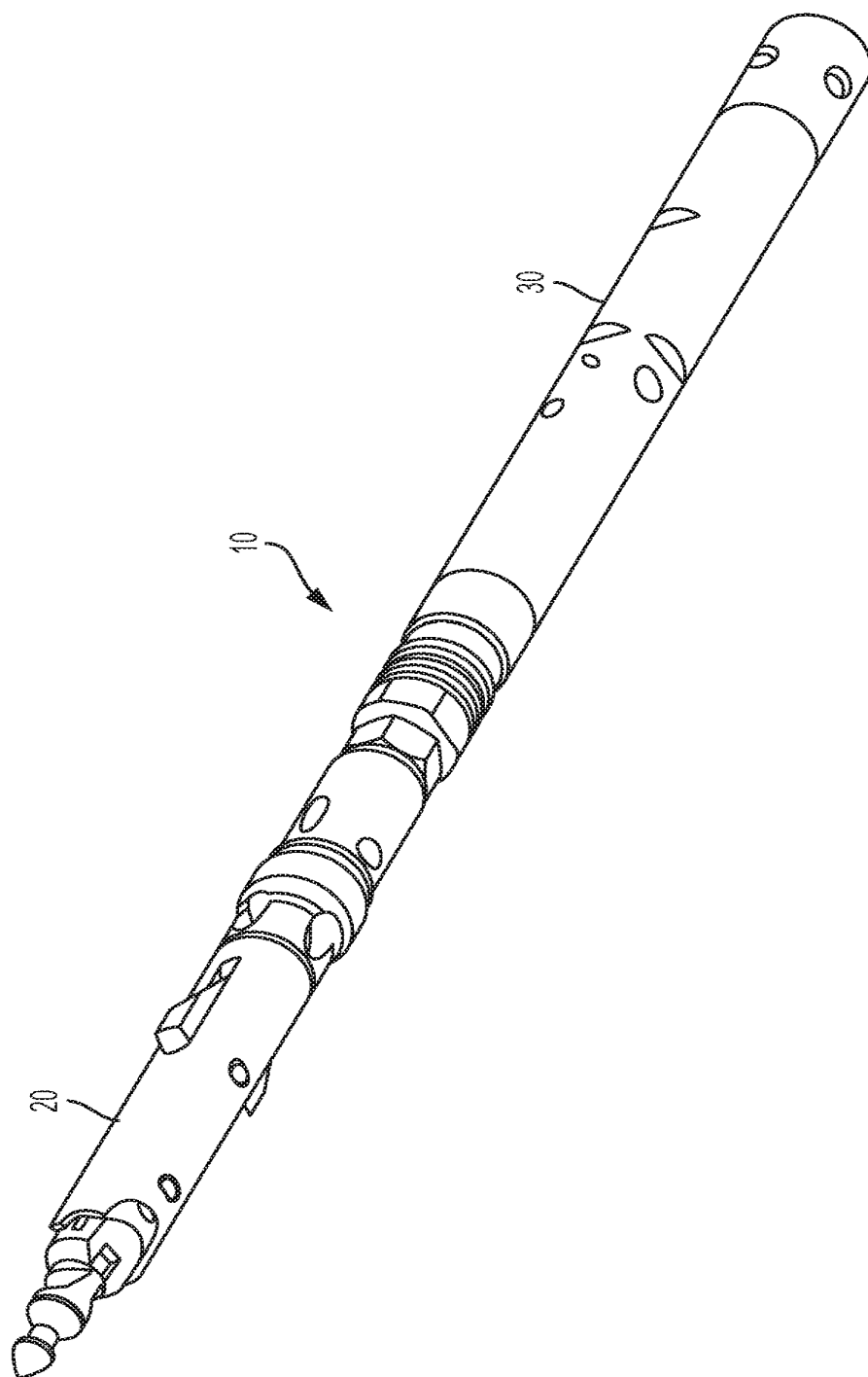
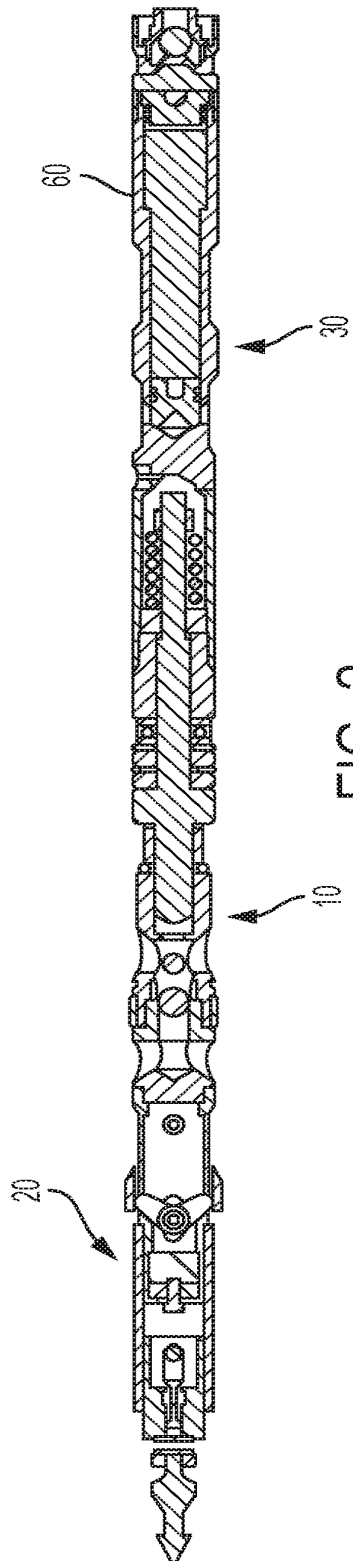
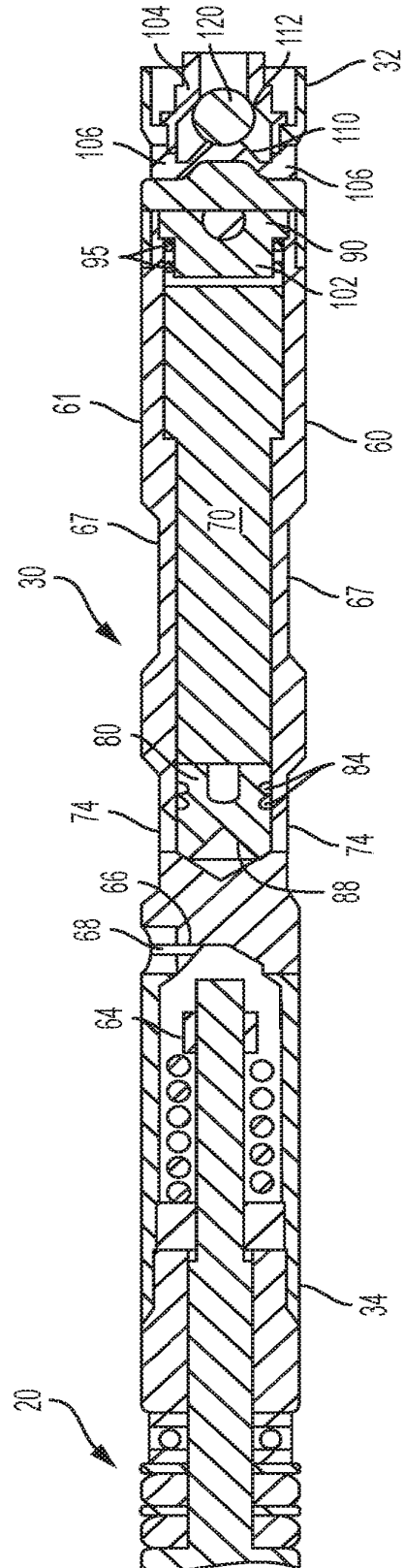


FIG. 1



2
G
L



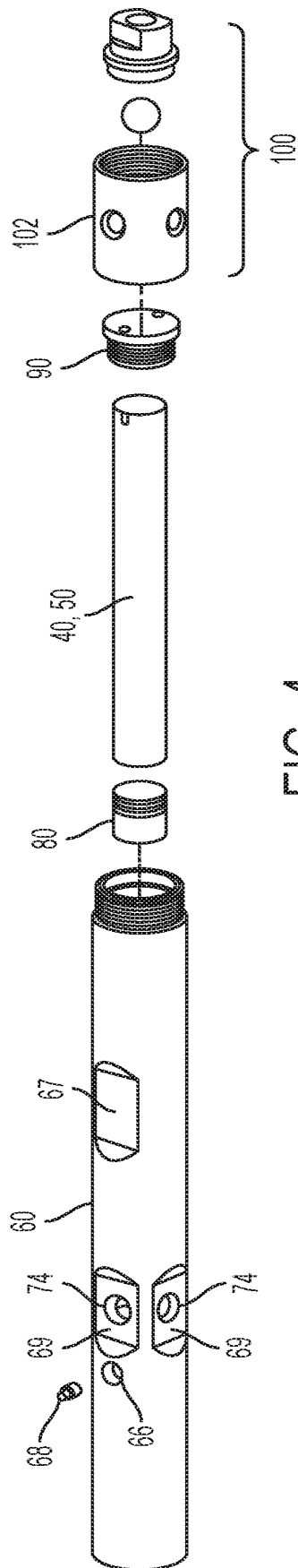


FIG. 4

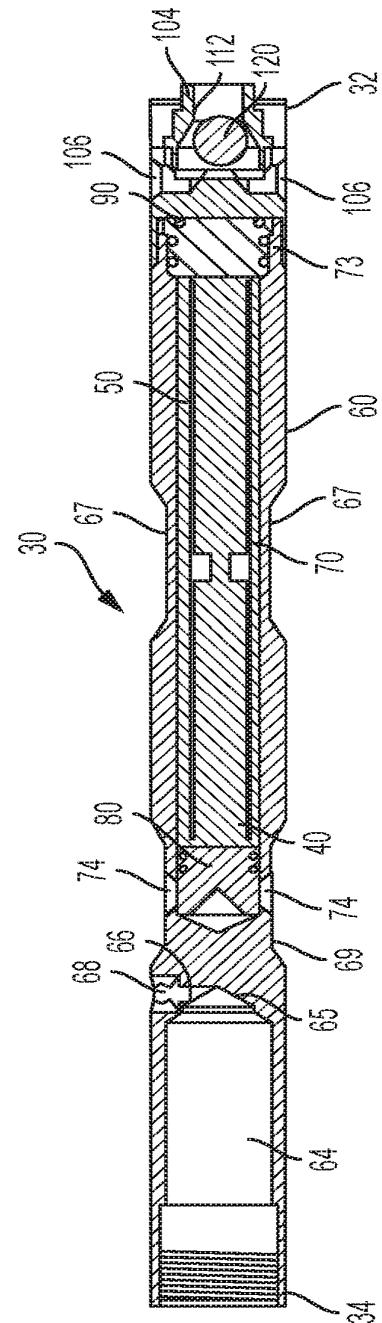
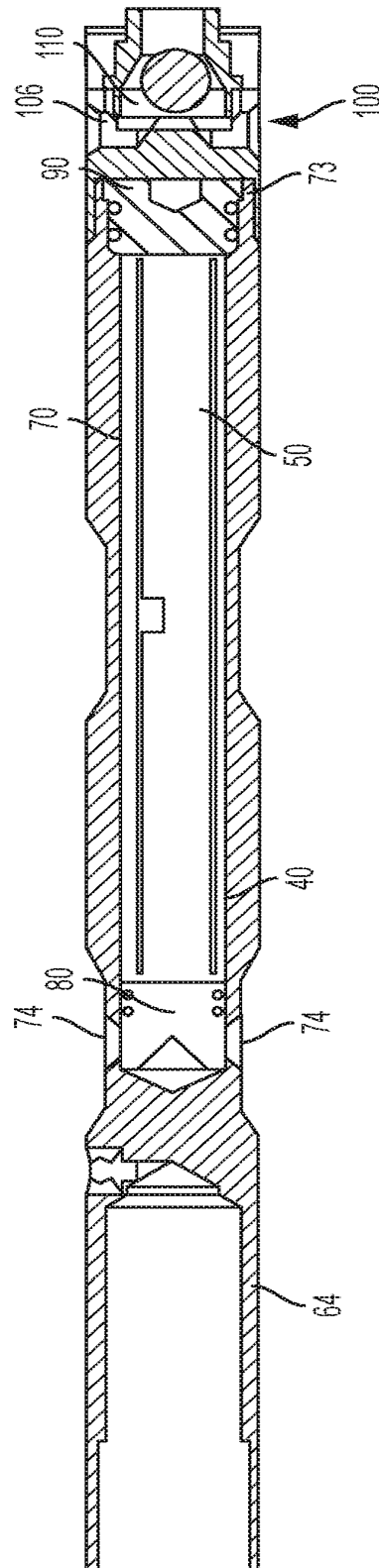


FIG. 5



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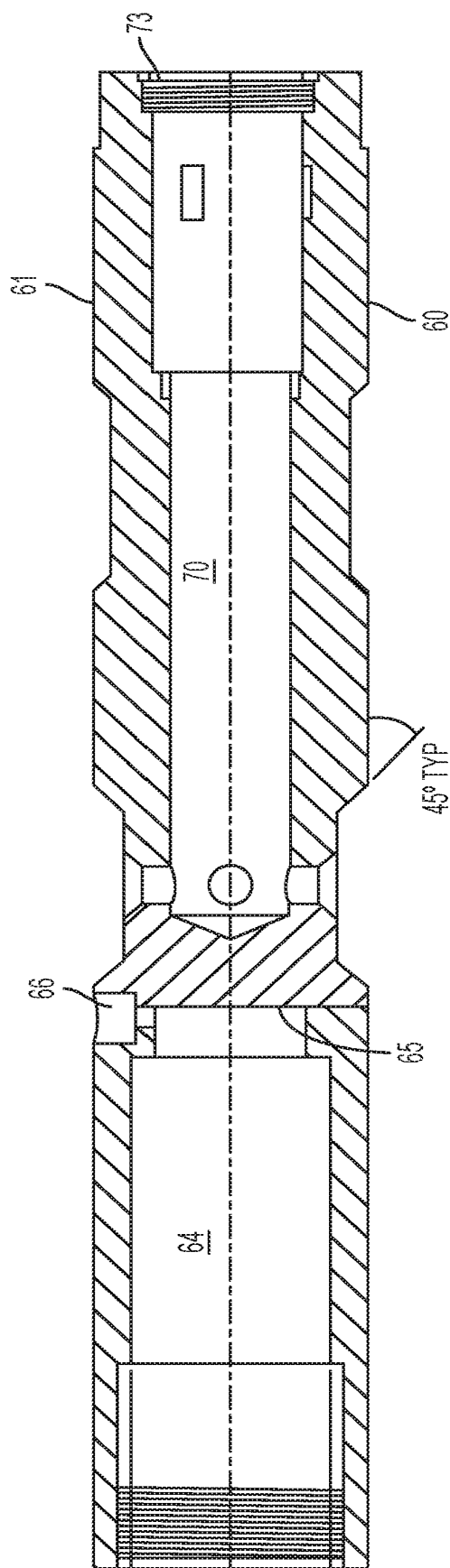
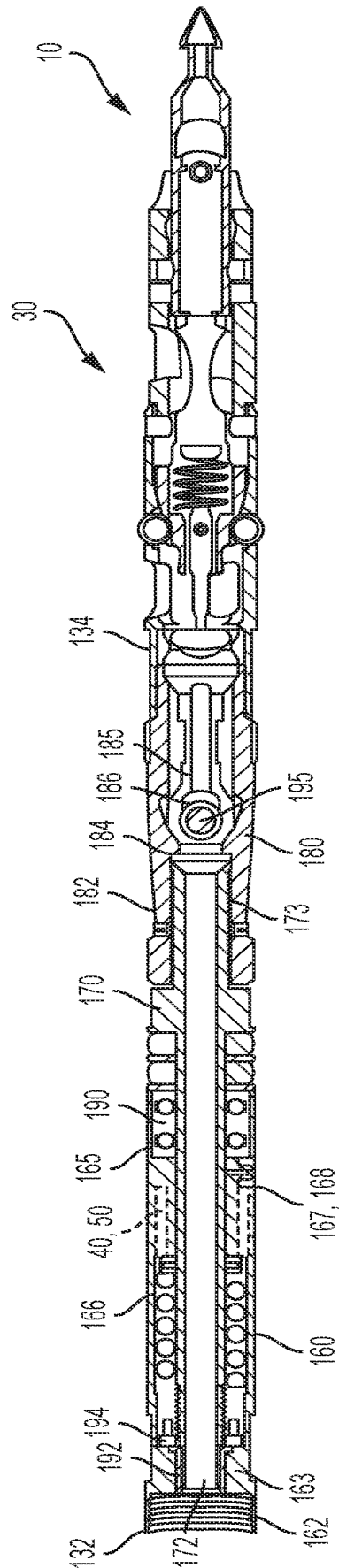


FIG. 7



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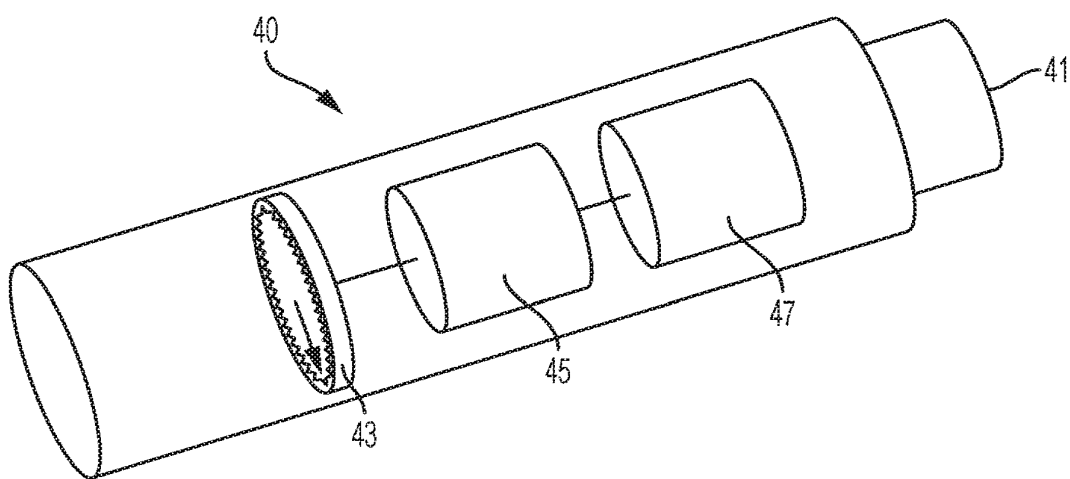


FIG. 9

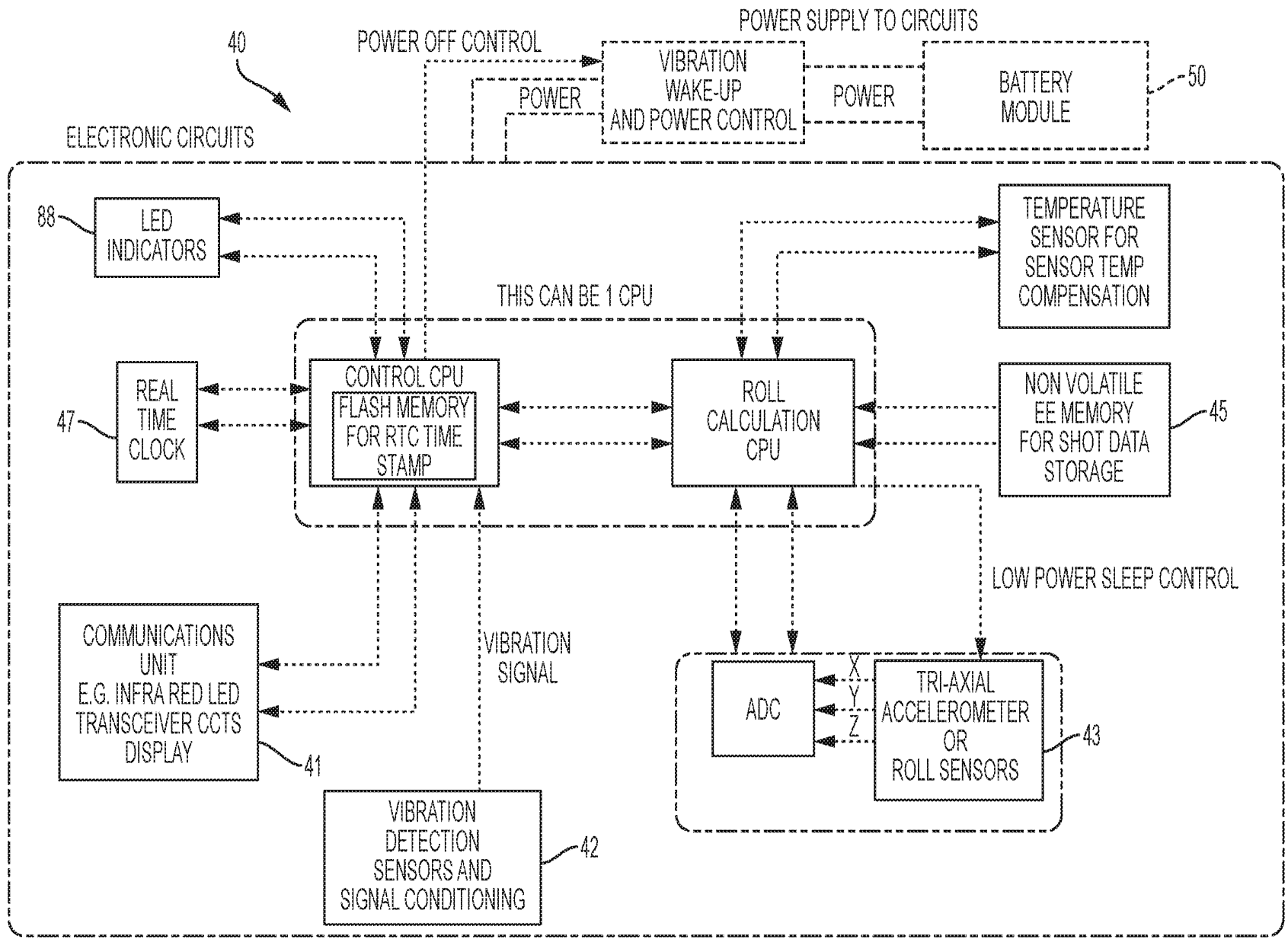


FIG. 10

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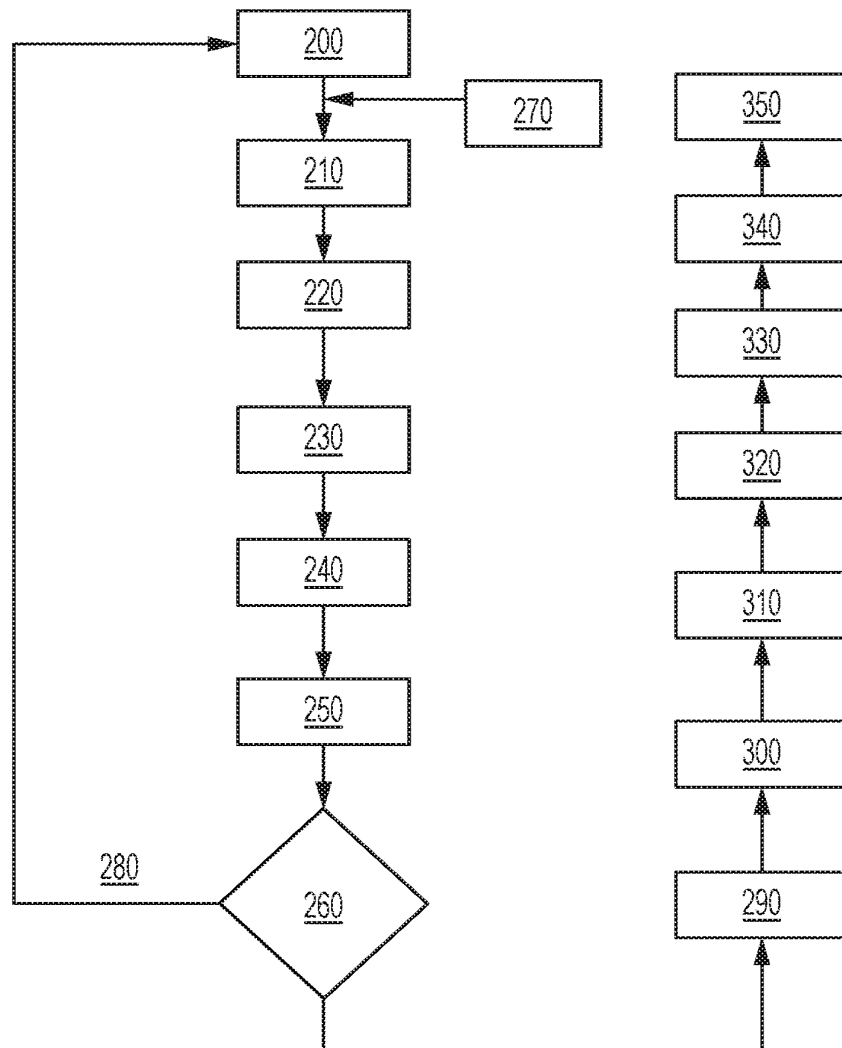


FIG. 11

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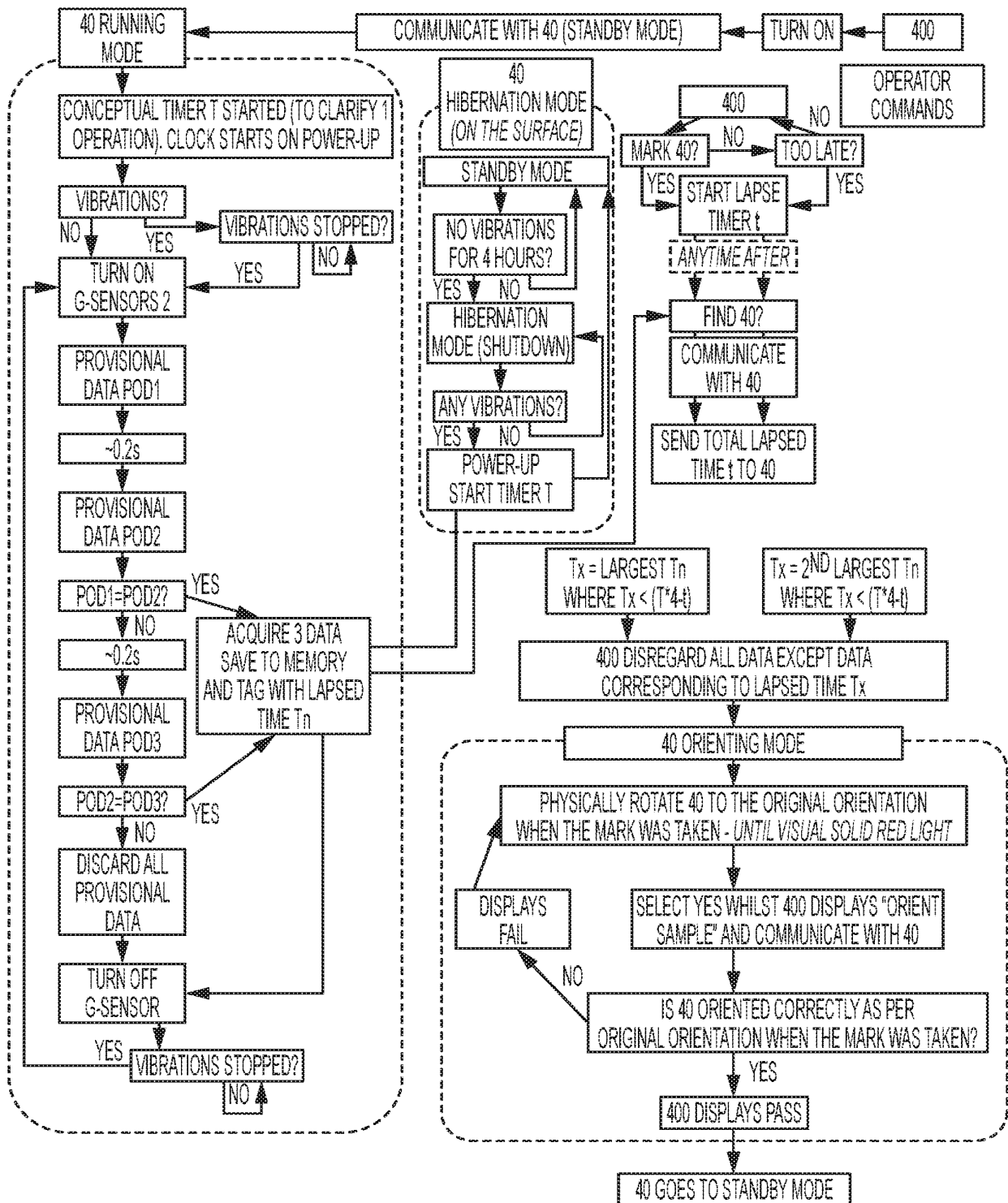


FIG. 12

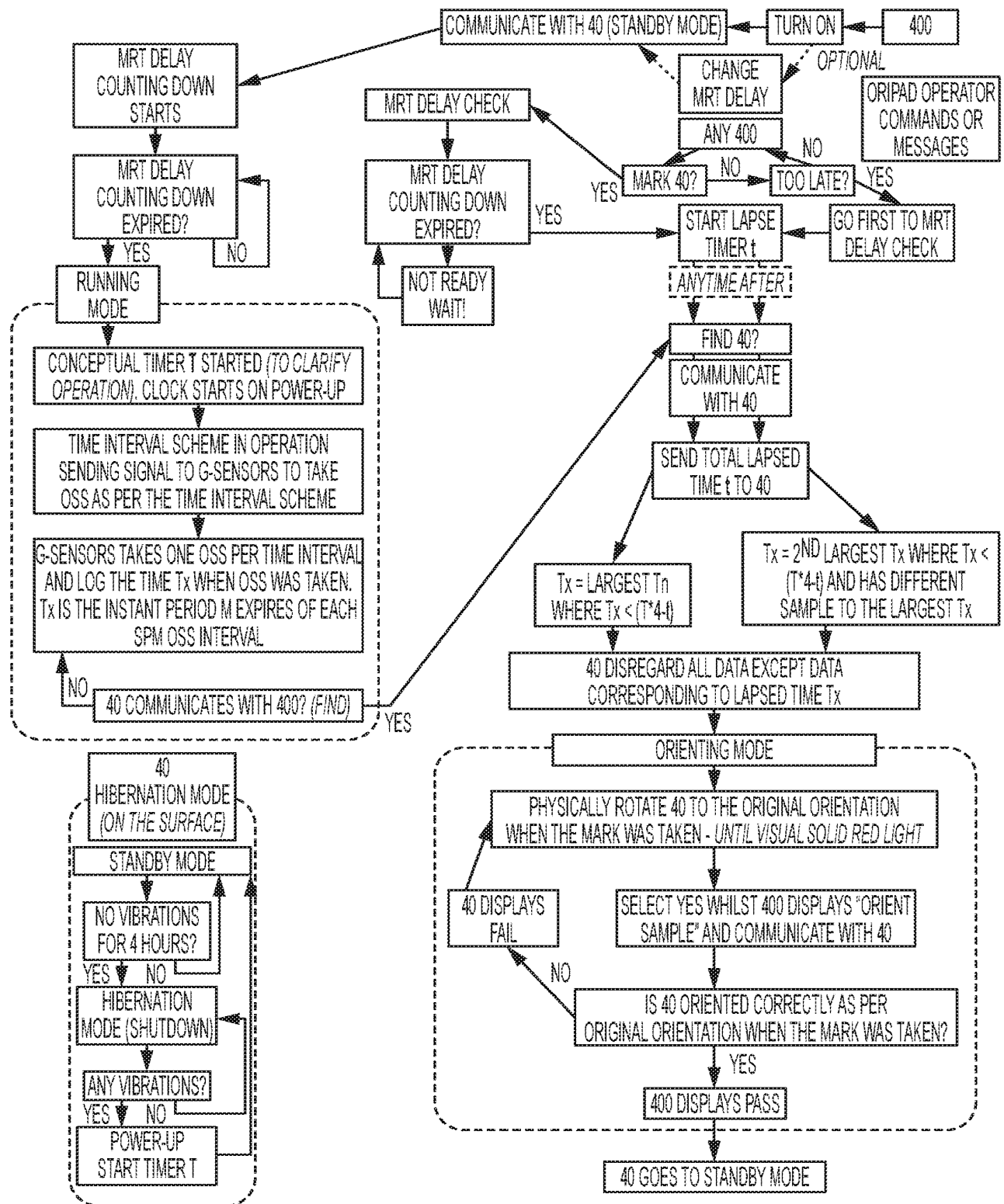


FIG. 13

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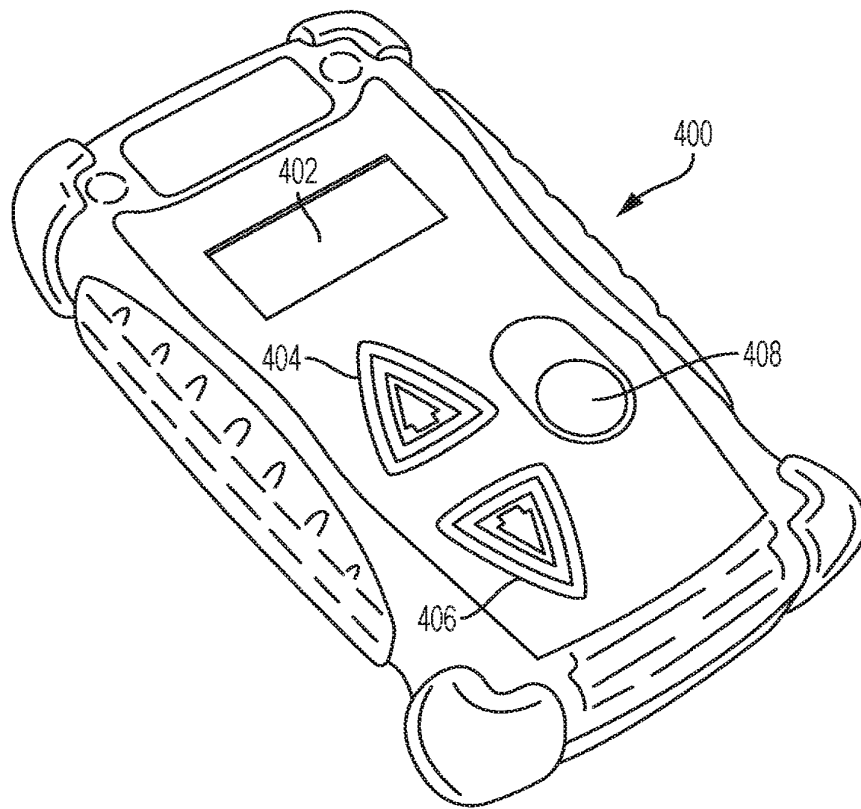


FIG. 14

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	CORE BARREL HEAD ASSEMBLY WITH AN INTEGRATED SAMPLE ORIENTATION TOOL AND SYSTEM FOR USING SAME			
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH			
Filer:	Joseph P. Anderson			
Attorney Docket Number:	36362.0150U3			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	1	100	100
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1820

Electronic Acknowledgement Receipt

EFS ID:	32989443
Application Number:	16017334
International Application Number:	
Confirmation Number:	6991
Title of Invention:	CORE BARREL HEAD ASSEMBLY WITH AN INTEGRATED SAMPLE ORIENTATION TOOL AND SYSTEM FOR USING SAME
First Named Inventor/Applicant Name:	CHRISTOPHER L. DRENTH
Customer Number:	23859
Filer:	Joseph P. Anderson
Filer Authorized By:	
Attorney Docket Number:	36362.0150U3
Receipt Date:	25-JUN-2018
Filing Date:	
Time Stamp:	15:53:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1820
RAM confirmation Number	062618INTEFSW15543600
Deposit Account	
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Authorization for Extension of Time all replies	36362_0150U3_Authorization_to_Treat_Reply_Requiring_EOT1.pdf	74133	no	1
			a04c14007a838f5bfb6d8dd45609fd7ce5017514		
Warnings:					
Information:					
2	Oath or Declaration filed	36362_0150U3_Declarations.PDF	289722	no	3
			bc99b865efd3e990431d00ea6fab1acfb1f3f53		
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3	Application Data Sheet	36362_0150U3_ADS.PDF	1256652	no	10
			69a918d3c0889071c31cb1ac49ebc1c6210600a6		
Warnings:					
Information:					
4		36362_0150U3_Application.pdf	164133	yes	37
			5650126aaeac05b6ded8e0e8fd980e88d7a30488		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	32	
	Claims		33	36	
	Abstract		37	37	
Warnings:					
Information:					

5	Drawings-only black and white line drawings	36362_0150U3_Figures.PDF	297599	no	12
			51bd1417d05d4295a7e91d28efa3d64932c4ba18		
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6	Fee Worksheet (SB06)	fee-info.pdf	36582	no	2
			6931e77a54e04ab25c889a66c6393008232e7bf8		
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Total Files Size (in bytes):			2118821		
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