

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:
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Date of mailing
(day/month/year) **30 January 2019 (30.01.2019)**

Applicant's or agent's file reference EZD462976WO		FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/US2018/054002	International filing date (day/month/year) 02 October 2018 (02.10.2018)	Priority date(day/month/year) 04 October 2017 (04.10.2017)	
International Patent Classification (IPC) or both national classification and IPC E21B 10/42(2006.01)i, E21B 10/54(2006.01)i			
Applicant BAKER HUGHES, a GE company, LLC			

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. I(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 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578	Date of completion of this opinion 30 January 2019 (30.01.2019)	Authorized officer HWANG, Chan Yoon Telephone No. +82-42-481-3347
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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2018/054002

Box No. 1 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. I(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. I(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. I(a)).
 - ☐ on paper or in the form of an image file (Rule 13ter. I(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/US2018/054002

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	<u>1-21</u>	YES
	Claims	<u>NONE</u>	NO
Inventive step (IS)	Claims	<u>NONE</u>	YES
	Claims	<u>1-21</u>	NO
Industrial applicability (IA)	Claims	<u>1-21</u>	YES
	Claims	<u>NONE</u>	NO

2. Citations and explanations :

Reference is made to the following document:

D1: US 2014-0262545 A1 (SMITH INTERNATIONAL, INC.) 18 September 2014

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 independent claim 1, discloses a drill bit (see figures 18-21) comprising: a bit body (1810) (see paragraph [0060] and figure 18); cutting elements (1832) mounted to a cutting face (1822) of the bit body (1810), the cutting element (1832) having a cutting face, wherein the cutting face of the cutting elements (1832) having a positive back rake angle α has a cutting face that engages the formation material at an angle that is greater than 90° when measured from the formation material, and faces a direction of intended rotation of the drill bit (see paragraphs [0060]-[0062], [0092] and figures 9-11, 18); and pointed cutting elements (1844) mounted to the cutting face (1822) of the bit body (1810) in a cone region of the bit body (1810), the pointed cutting elements (1844) having a cutting crest (312), wherein the pointed cutting elements (1844) having a positive back rake angle α have an axis that engages the formation material at an angle that is greater than 90° when measured from the formation material, and face a direction of intended rotation of the drill bit (see paragraphs [0045], [0061], [0093] and figures 9-11, 15, 18).

Claim 1 differs from D1 in that an earth-boring tool comprises cutting faces of second cutting elements back raked to about a same or greater extent than first cutting elements. However, this feature is merely a matter of design option to a person skilled in the art, considering the cutting elements (1832) having the positive back rake angle α and the pointed

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cutting elements (1844) having a positive back rake angle α in D1 (see paragraphs [0092], [0093] and figures 9-11). Accordingly, claim 1 would have been obvious over D1. Therefore, claim 1 does not involve an inventive step under PCT Article 33(3).

1.2 Dependent Claims 2-16

1.2.1 Claim 2

The additional feature of claim 2 is identical to the feature of D1 in that the bit body (1810) comprises blades (1820), wherein the cutting elements (1832) and the pointed cutting elements (1844) are mounted to the blades (1820) (see paragraphs [0060], [0061] and figure 18). Accordingly, claim 2 would have been obvious over D1. Therefore, claim 2 does not involve an inventive step under PCT Article 33(3).

1.2.2 Claim 3

The additional feature of claim 3 is characterized in that the second cutting elements rotationally trail respective adjacent first cutting elements on a same blade. This feature would be easily conceived from the disclosure of D1 considering that the pointed cutting elements (1844) are located adjacent to the cutting elements (1832) on the blades (1820) (see paragraphs [0060], [0061] and figure 18). Accordingly, claim 3 would have been obvious over D1. Therefore, claim 3 does not involve an inventive step under PCT Article 33(3).

1.2.3 Claim 4

The additional feature of claim 4 is characterized in that the second cutting elements rotationally lead respective adjacent first cutting elements on a different blade. This feature would be easily conceived from the disclosure of D1 considering that the cutting elements (1842) may be positioned on the blade (1820) at an angle ranging from greater than 0 degrees to 40 degrees, and the pointed cutting elements (1844) may be positioned on the blade (1820) at an angle ranging from 0 degrees to 20 degrees (see paragraph [0061] and figure 18). Accordingly, claim 4 would have been obvious over D1. Therefore, claim 4 does not involve an inventive step under PCT Article 33(3).

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1.2.4 Claims 5 and 6

The additional features of claims 5 and 6 are characterized in that at least some of the second cutting elements are located to at least partially overlap a cutting path of a respective adjacent first cutting element (claim 5); and at least some of the second cutting elements are located substantially between cutting paths of two radially adjacent first cutting elements (claim 6). These features would be easily conceived from the disclosure of D1 considering that the pointed cutting elements (1844) are located adjacent to the cutting elements (1832) (see paragraphs [0060], [0061] and figure 18). Accordingly, claims 5 and 6 would have been obvious over D1. Therefore, claims 5 and 6 do not involve an inventive step under PCT Article 33(3).

1.2.5 Claim 7

The additional feature of claim 7 is identical to the feature of D1 in that the cutting elements (1832) and the pointed cutting elements (1844) include a hard cutting layer of polycrystalline diamond ("PCD") or other superabrasive materials such as thermally stable diamond or polycrystalline cubic boron nitride (see paragraphs [0004], [0086]-[0089] and figure 18). Accordingly, claim 7 would have been obvious over D1. Therefore, claim 7 does not involve an inventive step under PCT Article 33(3).

1.2.6 Claim 8

The additional feature of claim 8 is characterized in that the blades define a profile of the body, the profile comprising the cone region, a nose region radially outward of and surrounding the cone region, a shoulder region radially outward of and surrounding the nose region, and a gage region radially outward of and surrounding the shoulder region. This feature is merely a matter of design option to a person skilled in the art, considering the blade (2020) having a cone region (2050), a shoulder region (2060), and a gage region (2070) in D1 (see paragraph [0065] and figures 20, 21). Accordingly, claim 8 would have been obvious over D1. Therefore, claim 8 does not involve an inventive step under PCT Article 33(3).

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1.2.7 Claim 9

The additional feature of claim 9 is characterized in that the second cutting elements are located only in the cone region. This feature would be easily conceived from the disclosure of D1 considering that the pointed cutting elements (1844, 2044) are located in the cone region (2050) (see paragraph [0065] and figures 20, 21). Accordingly, claim 9 would have been obvious over D1. Therefore, claim 9 does not involve an inventive step under PCT Article 33(3).

1.2.8 Claim 10

The additional feature of claim 10 is characterized in that the second cutting elements are superabrasive cutting elements rotationally leading, trailing or between respective adjacent first superabrasive cutting elements. This feature would be easily conceived from the disclosure of D1 considering that the pointed cutting elements (1844) are located adjacent the cutting elements (1832), wherein the cutting elements (1832) and the pointed cutting elements (1844) include a hard cutting layer of polycrystalline diamond ("PCD") or other superabrasive materials such as thermally stable diamond or polycrystalline cubic boron nitride (see paragraphs [0004], [0060], [0061], [0086]-[0089] and figure 18). Accordingly, claim 10 would have been obvious over D1. Therefore, claim 10 does not involve an inventive step under PCT Article 33(3).

1.2.9 Claim 11

The additional feature of claim 11 is characterized in that the first superabrasive cutting elements exhibit an arcuate cutting edge, and the second superabrasive cutting elements exhibit a cutting edge of greater radius than a radius of the cutting edge of the first superabrasive cutting elements. This feature would be easily conceived from the disclosure of D1 considering that the cutting elements (1842) may be positioned on the blade (1820) at an angle ranging from greater than 0 degrees to 40 degrees, wherein the pointed cutting elements (1844) may be positioned on the blade (1820) at an angle ranging from 0 degrees to 20 degrees, and wherein the cutting elements (1832) and the pointed cutting elements (1844) include a hard cutting layer of polycrystalline diamond ("PCD") or other superabrasive materials such as thermally stable diamond or polycrystalline cubic boron nitride (see paragraphs [0004], [0061], [0086]-[0089] and figure 18). Accordingly, claim 11 would have been obvious over D1. Therefore, claim 11 does not involve an inventive step under PCT Article 33(3).

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1.2.10 Claim 12

The additional feature of claim 12 is characterized in that the cutting edges of the second superabrasive cutting elements are trailed by apex surfaces of measurable depth. This feature would be easily conceived from the disclosure of D1 considering that an apex of the pointed cutting elements (1844) may have curvature, including a radius of curvature, wherein the radius of curvature may range from about 0.050 to 0.125, and wherein the cutting elements (1832) and the pointed cutting elements (1844) include a hard cutting layer of polycrystalline diamond ("PCD") or other superabrasive materials such as thermally stable diamond or polycrystalline cubic boron nitride (see paragraphs [0004], [0066], [0086]-[0089] and figure 18). Accordingly, claim 12 would have been obvious over D1. Therefore, claim 12 does not involve an inventive step under PCT Article 33(3).

1.2.11 Claims 13-15

The additional feature of claims 13-15 are characterized in that the height of exposure of the first cutting elements in the cone region and the height of exposure of the second cutting elements are substantially the same (claim 13); the height of exposure of the second cutting elements is less than the height of exposure of the first cutting elements in the cone region (claim 14); and the height of exposure of the second cutting elements is greater than the height of exposure of the first cutting elements in the cone region (claim 15). These features are merely matters of design option to a person skilled in the art, considering the cutting elements (1832) and the pointed cutting elements (1844) that are located in the cone region (2050) in the blade (1820, 2020) in D1 (see paragraph [0065] and figures 18, 20, 21). Accordingly, claims 13-15 would have been obvious over D1. Therefore, claims 13-15 do not involve an inventive step under PCT Article 33(3).

1.2.12 Claim 16

The additional feature of claim 16 is characterized in that the cone region is devoid of bearing elements. This feature is merely a matter of design option to a person skilled in the art, considering the cone region (2050) of the blade (2020) in D1 (see paragraph [0065] and figures 18, 20, 21). Accordingly, claim 16 would have been obvious over D1. Therefore, claim

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16 does not involve an inventive step under PCT Article 33(3).

1.3 Independent Claim 17

D1, which is considered to be the closest prior art to the subject matter of independent claim 17, discloses a drill bit (see figures 18-21) comprising: a bit body (1810) (see paragraph [0060] and figure 18); cutting elements (1832) mounted to blades (1820), the cutting element (1832) having a cutting face, wherein the cutting face of the cutting elements (1832) having a positive back rake angle α has a cutting face that engages the formation material at an angle that is greater than 90° when measured from the formation material, and faces a direction of intended rotation of the drill bit (see paragraphs [0060]-[0062], [0092] and figures 9-11, 18); and pointed cutting elements (1844) mounted to the blades (1820), the pointed cutting elements (1844) having a cutting crest (312), wherein the pointed cutting elements (1844) having a positive back rake angle α have an axis that engages the formation material at an angle that is greater than 90° when measured from the formation material, and face a direction of intended rotation of the drill bit (see paragraphs [0045], [0061], [0093] and figures 9-11, 15, 18), and wherein the cutting elements (1832) and the pointed cutting elements (1844) include a hard cutting layer of polycrystalline diamond ("PCD") or other superabrasive materials such as thermally stable diamond or polycrystalline cubic boron nitride (see paragraphs [0004], [0086]-[0089] and figure 18).

Claim 17 differs from D1 in adjacent second superabrasive cutting elements exhibiting substantially the same or less exposure above an axially leading face of common blade as the first superabrasive cutting elements. However, this feature is merely a matter of design option to a person skilled in the art, considering the cutting elements (1832) and the pointed cutting elements (1844) that are located in a cone region (2050) in the blade (1820, 2020) in D1 (see paragraph [0065] and figures 18, 20, 21). Accordingly, claim 17 would have been obvious over D1. Therefore, claim 17 does not involve an inventive step under PCT Article 33(3).

1.4 Dependent Claims 18-20

1.4.1 Claim 18

The additional feature of claim 18 is characterized in that the second superabrasive cutting elements are located only in the cone region of the blade faces of the earth-boring tool. This

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feature would be easily conceived from the disclosure of D1 considering that the cutting elements (1832) and the pointed cutting elements (1844) are located in the cone region (2050) in the blade (1820, 2020) (see paragraph [0065] and figures 18, 20, 21). Accordingly, claim 18 would have been obvious over D1. Therefore, claim 18 does not involve an inventive step under PCT Article 33(3).

1.4.2 Claim 19

The additional feature of claim 19 is characterized in that cutting faces of the second superabrasive cutting elements exhibit a back rake about a same as or greater than cutting faces of the adjacent first superabrasive cutting elements. This feature is merely a matter of design option to a person skilled in the art, considering the cutting elements (1832) having the positive back rake angle α and the pointed cutting elements (1844) having a positive back rake angle α in D1 (see paragraphs [0092], [0093] and figures 9-11). Accordingly, claim 19 would have been obvious over D1. Therefore, claim 19 does not involve an inventive step under PCT Article 33(3).

1.4.3 Claim 20

The additional feature of claim 20 is characterized in that a radius of curvature of cutting edges of cutting faces of the second superabrasive cutting elements is greater than a radius of curvature of cutting faces of the adjacent first superabrasive cutting elements. This feature would be easily conceived from the disclosure of D1 considering that an apex of the pointed cutting elements (1844) may have curvature, including a radius of curvature, wherein the radius of curvature may range from about 0.050 to 0.125, and wherein the cutting elements (1832) and the pointed cutting elements (1844) include a hard cutting layer of polycrystalline diamond ("PCD") or other superabrasive materials such as thermally stable diamond or polycrystalline cubic boron nitride (see paragraphs [0004], [0066], [0086]-[0089] and figure 18). Accordingly, claim 20 would have been obvious over D1. Therefore, claim 20 does not involve an inventive step under PCT Article 33(3).

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1.5 Independent Claim 21

D1, which is considered to be the closest prior art to the subject matter of independent claim 21, discloses a method comprising: engaging a formation to remove the formation material with cutting elements (1832, 142), wherein the cutting face of the cutting elements (1832) having a positive back rake angle α has a cutting face that engages the formation material at an angle that is greater than 90° when measured from the formation material (see paragraphs [0060]-[0062], [0092]-[0094] and figures 9-11, 18); and engaging the formation to remove the formation material with pointed cutting elements (1844, 144) in a cone region, wherein the pointed cutting elements (1844) having a positive back rake angle α has an axis that engages the formation material at an angle that is greater than 90° when measured from the formation material (see paragraphs [0060]-[0062], [0092]-[0094] and figures 9-11, 18).

Claim 21 differs from D1 in a rotary drag bit under applied WOB and TOB. However, this feature comes within the scope of the customary practice followed by a person skilled in the art. Accordingly, claim 21 would have been obvious over D1. Therefore, claim 21 does not involve an inventive step under PCT Article 33(3).

2. Industrial Applicability

Claims 1-21 are industrially applicable under PCT Article 33(4).