

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:
BEEBE, James, L.

Intellectual Property Counsel Baker Hughes, a GE Company,
LLC 17021 Aldine Westfield Houston, TX 77073 USA

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Applicant's or agent's file reference OIL4-506876-PCT-2		FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/US2020/047255	International filing date (day/month/year) 20 August 2020 (20.08.2020)	Priority date(day/month/year) 17 September 2019 (17.09.2019)	
International Patent Classification (IPC) or both national classification and IPC C10G 29/10(2006.01)i, C10G 29/20(2006.01)i, C10G 33/04(2006.01)i, C10L 3/10(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 02 December 2020 (02.12.2020)	Authorized officer KWON, YONGKYONG Telephone No. +82-42-481-3371
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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2020/047255

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 43*bis*.1(b))

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 13*ter*.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 13*ter*.1(a)).
☐ on paper or in the form of an image file (Rule 13*ter*.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:

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	2-4,8-22	YES
	Claims	1,5-7	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-22	NO
Industrial applicability (IA)	Claims	1-22	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: US 2011-0076246 A1 (HALEY, BOYD E. et al.) 31 March 2011

D2: US 2011-0172473 A1 (NGUYEN, TRAN M. et al.) 14 July 2011

D3: US 2015-0068749 A1 (WERNIMONT, ERIC JOHN) 12 March 2015

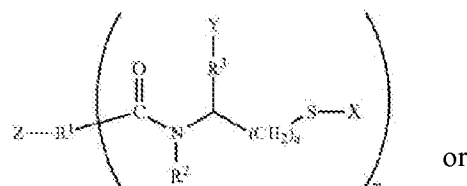
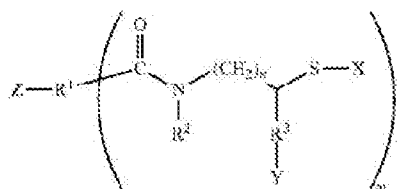
D4: US 6117333 A (FRANKIEWICZ, THEODORE C. et al.) 12 September 2000

D5: MA, LUN et al., Journal of Materials Chemistry C, 31 March 2014, Vol. 2, No. 21, pages 4239-4246.

I . Novelty and Inventive Step (PCT Article 33(2) and (3))

D1 is considered to be the closest prior art and discloses a method of removing metals from a starting material such as surface, ground, or waste water, comprising: i) admixing the starting material with a novel sulfur-containing chelate ligand to form a stable ligand-metal complex,

wherein the chelate ligand has a formula:



, where R^1 can be benzene or alkyl groups such as $(\text{CH}_2)_y$

where $y=2-8$; R^2 can be hydrogen, alkyls or aryls; R^3 can be alkyls or aryls; X can be hydrogen; n may independently equal 1-10; m may equal 1-6; Y can be hydrogen; and Z can be hydrogen; and ii) separating the complex from the starting material, and also discloses that the starting material such as liquid including metals is contacted with the novel sulfur-containing chelate ligand thereby forming the stable ligand-metal complex, wherein

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examples of the metals include vanadium, chromium, uranium, manganese, iron, cobalt, copper, silver, zinc, cadmium, mercury, lead, tin and the like (see paragraphs [0020], [0021], [0061], [0062]).

1. Claim 1-12

1.1. Claims 1 and 5-7

As all the features of claims 1 and 5-7 are disclosed in D1, these claims are anticipated by D1. Therefore, claims 1 and 5-7 are neither novel nor inventive over D1. Claims 5-7 are assumed to be dependent on claim 1.

1.2. Claim 12

The additional feature of claim 12 can be selected by a person skilled in the art within his technical common sense. Therefore, claim 12 does not involve an inventive step over D1. Claim 12 is assumed to be dependent on claim 1.

1.3. Claims 2-4 and 8-11

The additional features of claims 2, 3 and 9 are not disclosed in D1. However, D2 discloses that acetic acid has sometimes been used to remove metals, and a method comprises: adding a composition including a demulsifier to a hydrocarbon stream to significantly reduce the amount of iron and other metals in the hydrocarbon such as crude oil, wherein the demulsifier can be an oxyalkylated alkyl resin including the reaction products of blends of two or three phenols added together and then reacting this mixture with formaldehyde (see paragraphs [0021], [0025], [0029], [0030], [0039], [0066]). Considering that D1 and D2 are in the same technical field relating to treatment for reducing metals in liquid, a person skilled in the art would easily arrive at the features by applying the acetic acid and the demulsifier of D2 to the invention of D1 without difficulty, and its effect would be predictable.

The additional feature of claim 11 can be selected by a person skilled in the art within his technical common sense considering the disclosure of D1 that the complex is separated from the starting material such as liquid (see paragraphs [0061], [0062]) and the disclosure of D2 that the method is for reducing the metals in the hydrocarbon such as crude oil (see paragraphs [0021], [0025]).

Therefore, claims 2, 3, 9 and 11 do not involve an inventive step over D1 in view of D2. Claim 11 is assumed to be dependent on claim 2.

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Regarding the additional feature of claim 8, D2 discloses that the method is for reducing the metals in the hydrocarbon such as crude oil (see paragraphs [0021], [0025]) and D3 discloses a method for recovery of hydrocarbons from a formation, comprising injecting at least one liquid fluid from the surface of the earth through at least one conduit into at least one wellbore, wherein the injected fluid can include pour point depressants (see claims 1, 34). Although D3 is not exactly in the same technical field as D1 and D2, there is no reason to restrict its usefulness in one narrow, specific industry considering that it is generally known to a person skilled in the art that the pour point depressant is commonly applied to a hydrocarbon stream, and the amount of the pour point depressant can be easily optimized by repeated experiments practiced by a person skilled in the art. Accordingly, a person skilled in the art would easily arrive at the feature by applying the pour point depressant of D3 to the inventions of D1 and D2 without difficulty, and its effect would be predictable. Therefore, claim 8 does not involve an inventive step over D1 in view of D2 and D3. Claim 8 is assumed to be dependent on claim 2.

The additional feature of claim 4 is not disclosed in D1. However, D4 discloses that suitable water clarifiers are added to a pre-treated wastewater stream and act to enhance the attraction of wastewater contaminants, such as elemental mercury-containing particulates, with destabilized, emulsified hydrocarbon droplets for convenient separation from the water (see column 1, lines 42-56; and column 2, lines 1-8). Considering that D1 and D4 are in the same technical field, a person skilled in the art would easily arrive at the feature by applying the water clarifier of D4 to the invention of D1 without difficulty, and its effect would be predictable.

The additional feature of claim 10 is merely a variation of the disclosure of D4 that examples of the water clarifiers include anionic or cationic polymers, or other water clarifiers known to those skilled in the art (see column 3, lines 45-52).

Therefore, claims 4 and 10 do not involve an inventive step over D1 in view of D4.

2. Claims 13-22

Claim 13 differs from D1 in that an additive comprises a component selected from the group consisting of at least one demulsifier, a buffering agent, a water clarifier, a pour point depressant, and combinations thereof.

However, 1) D2 discloses that acetic acid has sometimes been used to remove metals, and the addition of a composition including a demulsifier to a hydrocarbon stream can significantly

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reduce the amount of iron and other metals in the hydrocarbon such as crude oil (see paragraphs [0021], [0025], [0039]), and 2) D4 discloses that suitable water clarifiers are added to a pre-treated wastewater stream and act to enhance the attraction of wastewater contaminants, such as elemental mercury-containing particulates, with destabilized, emulsified hydrocarbon droplets for convenient separation from the water (see column 1, lines 42-56; and column 2, lines 1-8). Considering this, a person skilled in the art would easily arrive at the subject matter of claim 13 by applying 1) the acetic acid and the demulsifier of D2, or 2) the water clarifier of D4 to the invention of D1 without difficulty, and its effect would be predictable.

Therefore, claim 13 does not involve an inventive step over D1 in view of D2 or D4.

Regarding the additional features of claims 14, 16 and 18, D1 discloses the starting material such as waste water (see paragraphs [0061], [0062]), and D2 discloses that the acetic acid has sometimes been used to remove metals and the composition including the demulsifier is added to crude oil (see paragraphs [0021], [0025], [0039]).

The additional feature of claim 17 can be easily optimized by repeated experiments practiced by a person skilled in the art.

The additional feature of claim 19 is merely a variation of the disclosure of D2 that a proportion of the demulsifier in the composition ranges from about 1-50 wt.% based on the total composition (see paragraphs [0025], [0034]).

Regarding the additional feature of claim 22, D1 discloses that the novel sulfur-containing chelate ligand binds the metals in the starting material such as liquid resulting in the stable ligand-metal complex (see paragraphs [0020], [0061], [0062]).

Therefore, claims 14, 16-19 and 22 do not involve an inventive step over D1 in view of D2. Claims 16-18 and 22 are assumed to be dependent on claim 13.

Regarding the additional feature of claim 20, D4 discloses that the water clarifiers are added to the pre-treated wastewater stream (see column 2, lines 1-3).

The additional feature of claim 21 can be easily optimized by repeated experiments practiced by a person skilled in the art.

Therefore, claims 20 and 21 do not involve an inventive step over D1 in view of D4. Claim 20 is assumed to be dependent on claim 13.

The additional feature of claim 15 is not disclosed in D1 or D2. However, D5 discloses that both thio and amine groups from cysteamine bond with copper ions thereby forming a Cu-cysteamine complex (see abstract). Although D5 is not exactly in the same technical field as

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D1 and D2, there is no reason to restrict its usefulness in one narrow, specific industry. Accordingly, a person skilled in the art would easily replace the sulfur-containing chelate ligand of D1 with the cysteamine of D5 without difficulty to solve the subject matter proposed in the present invention. Therefore, claim 15 does not involve an inventive step over D1 in view of D2 and D5.

II . Industrial Applicability (PCT Article 33(4))

Claims 1-22 are industrially applicable.

[Note]

- The terms "1,2 dithioethane", "N,N dimethyl cysteamine" and "1, 3, 5 triazine, 2,4,6 trithiol" used in claim 15 are writing errors for "1,2-dithioethane", "N,N-dimethyl cysteamine" and "1,3,5-triazine-2,4,6-trithiol", respectively.