PATENT COOPERATION TREATY

From the:
INTERNATIONAL SEARCHING AUTHORITY

To:

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*
27 February 2020

Applicant's or agent's file reference	**FOR FURTHER ACTION**
P44593PCAU	See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/AU2019/051319	04 December 2019	05 December 2018

International Patent Classification (IPC) or both national classification and IPC
C22B 3/02 (2006.01) ***C22B 3/04 (2006.01)*** ***B01J 3/02 (2006.01)*** ***B01J 3/04 (2006.01)*** ***B01J 8/08 (2006.01)*** ***B01D 11/00 (2006.01)***

Applicant
CLEGG, Robert, Louis

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

- [X] 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
- [X] Box No. V — Reasoned statement under Rule 43*bis*.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
- [X] 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 66.1*bis*(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	Date of completion of this opinion	**Authorised Officer**
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustralia.gov.au	27 February 2020	Kosala Gunatillaka AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61262223652

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/AU2019/051319

Box No. I Basis of this opinion

1. With regard to the **language,** this opinion has been established on the basis of:

   [X] 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 (under 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 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/AU2019/051319

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

1. Statement

Novelty (N)	Claims **8 - 10, 12 - 19, 26, 29**	**YES**
	Claims **1 – 7, 11, 20 - 25 , 27 - 28, 30 - 34**	**NO**
Inventive step (IS)	Claims **8 - 10, 26**	**YES**
	Claims **1 - 7, 11 - 25, 27 - 34**	**NO**
Industrial applicability (IA)	Claims **1 - 34**	**YES**
	Claims **None**	**NO**

2. CITATIONS AND EXPLANATIONS:

CITATIONS

D1: CN 106222404 A (CHINA ENFI ENG CORP) 14 December 2016, Bibliography from Espacenet and English machine translation from GOOGLE PATENTS
D2: US 2926182 A (MACK SUTTON) 23 February 1960
D3: US 4971678 B (STRICKLAND) 20 November 1990
D4: CN 102942971 B (UNIV TAIYUAN TECHNOLOGY; SEDIN ENGINEERING CO LTD) 15 January 2014, Bibliography from Espacenet and English machine translation from GOOGLE PATENTS
D5: US 2010/0326920 A1 (CUTLER et al.) 30 December 2010
D6: US 1528206 A (W. E. GREENAWALT) 03 March 1925
D7: TW M540689 U (TEDA SAS [IT]) 01 May 2017, Bibliography from Espacenet and English machine translation from GOOGLE PATENTS

NOVELTY (N)

Claims 1 – 7, 11, 20 - 25, 27 – 28 and 30 - 34 are not novel and therefore do not comply with PCT Article 33(2).

D1 discloses all the features of claims 1 – 7, 11, 20 - 21, 27 – 28 and 30 - 34.

With respect claims 1 – 7, 11, 21 and 27 – 28, discloses (abstract, Fig. 1, claim 1 – 5, a recovery system providing a kind of valuable metal by pressure oxidation of copper-cobalt-nickel sulfides at high temperature, in an apparatus comprising; an autoclave (11) having an oxygen inlet (113), a material inlet (111) and a material outlet (112); a dosing unit (50); and a slurry dilution with acid solutions provided with feedstock along the material flow (111). D1 also discloses said autoclave (11) comprises a kettle chamber and one or more partitions (114), with a plurality of interconnected chambers (115), and each of the chambers (115) is provided with the oxygen inlet (113) and a stirring device. The temperature in the kettle is controlled between 160 to 220 deg. C and feed pressure controls from 1.5 to 3.2MPa. The material from autoclave is connected to a flash evaporation unit (20), via an outlet pipe (not referenced in Fig.1) through a port on the wall, to separate the air (22) in the material flow from the slurry (312) and slurry subjected cleaning (33). The space (115) of the autoclave is a zone at least partially occupied by air which is removed with the material flow (112) from the autoclave and subsequently released in the flash evaporation unit (20). With respect to claim 21, D1 further discloses a supplementary air release device (118) closer to the material flow outlet (112). With respect to claims 27 - 30 and 33 - 34, D1 also discloses a oxidative pressure leaching process wherein the material flow (containing pressurized air) is directed to a flash evaporation unit (20) via an outlet pipe (not referenced in Fig.1). With respect to claims 31 – 32, D1 also discloses that the temperature and pressure of the autoclave is controlled in each of said chambers (115) by providing with a cooling water line inlet (116) and a steam line inlet (117) (claim 5) and the pressure of tank (11) is controlled by adjusting the pressure in the tank using the exhaust valve (118). A separate gas zone is not explicitly defined but such a zone is inherently present in the upper portion of the autoclave that is expected to have more gas than liquid.(Also see Google machine translation of the whole document).

D2 discloses all the features of claims 1 - 4, 6 – 7, 11, 27 – 28 and 34.

With reference to claims 1 – 4 and 6 - 7 and 11, D2 discloses (Fig. 1, claims 1 – 9 and from column 1, line 50 to column 4, line 32) a process and apparatus for continuous oxidation of aliphatic alcohols, the apparatus comprising; a vertically disposed column reactor (11) operating at suitable temperatures (650 to 740 deg. F) and pressures (about 200 psia) equipped with a stirrer having a plurality of turbines on it; liquid reactant inlets (34, 24) at the bottom of the reactor; an intimate mixture of hydrogen, water vapor,

unreacted alcohol, unreacted alkali metal hydroxide and product alkali metal carboxylates is continuously withdrawn from an upper portion of reactor (11) by way of an outlet conduit (37) and is passed to alcohol stripper (38) for further processing. During the reaction of the alcohol and the alkali metal hydroxide, hydrogen gas is evolved and removed with reaction products from the conduit or outlet pipe (37). D2 further discloses that, when the pressure and agitation and particularly temperature and space velocity are properly coordinated, the emulsion-like mass flows upwards through reactor (11) and out through conduit (37) without apparent separation of the gas from the solid and liquid components of the mixture. The said outlet pipe is connected to a port on the reactor (no reference number given) (Fig. 1). A separate gas zone is not explicitly defined but such a zone is inherently present in the upper portion of the reactor that is expected to have more gas than liquid. D1 further discloses that the said reactor is an autoclave with several compartments Fig. 1 and claims 1 – 7). With respect to claims 27 – 30 and 34, D2 further discloses that the product stream from outlet pipe (37) is led to another vessel (38) for further processing, that these two vessels may be operated at the same pressure or at different pressures by placing a valve in line (37).

D3 discloses all the features of claims 1 – 3, 7 and 11.

With respect to claims 1 – 3, 7 and 11, D3 discloses (abstract; Fig. 1, claim 1 and column 3, lines 27 – 47) a continuous process and an apparatus for treating a fluid hydrocarbon feedstock with a hydrogen-containing gas at elevated catalytic reaction temperatures and pressure in the presence of a bed of particulate solid catalyst; the apparatus comprising; a vertically disposed reactor (10); a liquid inlet (12) of heavy oil combined hydrogen gas; an outlet conduit (40) designed to withdraw vapor and liquid stream (24) along with any gas; suitable means for introducing and withdrawing catalyst particles, as conduit (15) through which fresh catalyst (16) is flowed and conduit (17) through which spent catalyst (14) is withdrawn. D3 also discloses that the reactor operates and constructed suitable for reacting liquids, liquid-solid slurries, solids and gases at elevated temperatures and pressures and in a preferred embodiment for treating hydrocarbon liquids with hydrogen at high pressures and high temperatures, e.g. 100 to 5000 psi and 300 DEGF. to 1500 deg. F and the reactor comprises three compartments.

D4 discloses all the features of claims 1 – 3, 7, 11 and 22 - 25.

D4 discloses application of Raney nickel in a slurry reactor to synthesize a methane catalyst, including: adding a raney nickel catalyst dispersed in an inert liquid medium to a reactor for a methanation reaction (p9 mixed with hydrocarbon (p7) and catalyst (p8)); a gas mixture of H2, CH4, CO and CO2 through gas inlet via p1; a slurry outlet via p6 for separation in the separator (4); gas - liquid outlet (p2) for septation in the separator (3) and separated liquid (p4) is recycled to line p9. A separate gas zone is not explicitly defined but the top portion of the reactor inherently occupies at least partially by gas which is exhausted with liquid via line p2 for separation. D4 also discloses that the reactor operates at temperatures 250 to 320 deg. C and pressures 1 to 6 MPa and the reactor comprises at least 2 compartments). With respect to claims 22 – 25, D4 further discloses an indirect heat exchanger (2) associated with the outlet pipe. (Also see Google machine translation of the whole document).

Claims 8 - 10, 12 - 19, 26 and 29 meet the criteria for novelty under PCT Article 33(2) because the subject matter of these claims not disclosed in the prior art.

None of the prior art explicitly disclose the specific combination of features of these claims such as; processing a ore-slurry in a vertically disposed vessel having an excess gas duct communicating with said outlet, whether internally or externally of said at least one vessel, directs the slurry up to at least to the desired level of the excess gas and liquid process stream interface; excess gas ducts from individual vessels, the outlet pipe further having a heat exchanger transferring heat with the process streams and the apparatus comprising a plurality of vessels with excess gas ducts as currently defined. None of the prior art also disclose features relating to staggered injection points to one or more compartments of the autoclave, a series of vessels wherein excess gas ducts bypass individual vessels or the last of the excess gas duct of autoclaves is directed to a separation vessel, the excess gas duct being connected at certain levels or heights relative to the slurry pipe, the outlet pipe having a heat changer of with process stream passages configured in a specific manner, and the flow of the stream through the excess gas duct is maintained at a velocity sufficient to erode scale formation.

INVENTIVE STEP (IS)

Given the above novelty objection, claims 1 – 7, 11, 20 - 25, 27 - 28, 30 - 34 do not involve an inventive step and therefore do not comply with PCT Article 33(3).

Claims 12 and 29 each does not involve an inventive step in light D1 to D4, therefore do not comply with PCT Article 33(3).

Staggered injection of reagents (as for claim 12) and the adjustment of the velocity of the stream of slurry not to erode the gas pipe (as for claim 29) are considered obvious arrangements that merely constitutes no more than mere workshop improvements. These are arrangements that any competent worker in the art would be expected to make directly and without difficulty and by routine steps alone without involving an inventive step.

Claims 13 – 19 do not involve an inventive step in light of D1 and therefore do not comply with PCT Article 33(3). Claims 13 – 19 further define an excess gas duct and its variations that it includes a control valve. Excess gas ducts are commonly found in pressure

vessels (reactors and autoclaves) to control pressure or for safety arrangements. Addition of an excess gas to the autoclave defined in D1 is merely constitutes no more than mere workshop improvements. These are arrangements that any competent worker in the art would be expected to make directly and without difficulty and by routine steps alone without involving an inventive step.

Claims 8 – 10 and 26 involves an inventive step and therefore comply with PCT Article 33(3).

None of the above prior art documents either individually or in combination obviously suggests to a person skilled in the art the specific combination of features such as, processing a ore-slurry in the said vessel having an excess gas duct communicating with said outlet pipe, whether internally or externally of said at least one vessel, directs the slurry up to at least to the desired level of the excess gas and liquid process stream interface and the outlet pipe further having a heat exchanger transferring heat between process streams, as currently defined.

INDUSTRIAL APPLICABILITY (IA)

The invention defined in the claims 1 - 34 is considered to meet the requirements of Industrial Applicability under Article 33(4) of the PCT because it can be made by, or used in, industry.

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:

1. Claims 1 and 27 do not comply with PCT Article 6 because they are not fully supported by the description. Claims are not fully supported if their subject matter is different to the subject matter of the description. The claims are inconsistent with the description because they omit one or more features that the description indicates is intrinsic to the invention as detailed below.

   i. The inlet liquid stream is defined in the description as a slurry (page 15 , lines 25 – 29), "In all cases too, the liquid process stream is a slurry of mineral ore or concentrate and leachant for conducting the hydrometallurgical process". It is to be noted that a slurry has solid particles and therefore cannot be considered as a liquid.

   ii. The said vessel appears to be an autoclave operating at pretermined temperatures and pressures (see page 15, lines 21 – 25, page 16, lines 1 - 10; and drawings Figs. 1 -8 & 11- 13), for "Referring to Figures 1 to 8, there are shown vertically disposed autoclaves 10 acting as reactors for performing a chemical process, especially in hydrometallurgy".

   iii. The said vessel has an arrangement to remove gas to the outlet pipe defined by "a duct communicating with said outlet, whether internally or externally of said at least one vessel, directs the slurry up to at least to the desired level of the excess gas and liquid process stream interface" (see description from page 16, lines 11 to page 17, line 5 and Figs. 2 – 8).

Without these features, the claims 1 and 27 are inconsistent with the description and so broadly defined that they encompass a variety of reactors that are not supported by the specification.

2. Following claims are not clear for the reasons given below.

   i. Claim 1 is not clear because, with reference to recitation…"wherein the zone at least partially occupied by a gas communicates with the outlet liquid process…", the term 'a gas' lacks proper antecedence as 'a gas' is defined previously as 'a zone at least partially occupied by a gas'.

   ii. Claim 21 is not clear because, with reference to recitation, "…directing a liquid process stream entraining the gas to an inlet of a vessel, at least a portion of the gas being directed to and partially occupying a zone of the vessel;", the term 'a vessel' lacks proper antecedence as , 'at least one vessel' is defined previously.

   iii. Claims 8 – 10 are not clear because, with respect to claims 8 – 9, the segment of the sentence, "the excess gas and liquid process stream interface", lacks proper antecedence. As a result, claim 10 (which depends on either claims 8 and 9) is not clear with reference to recitation, "wherein an excess gas port is provided at said interface in the case of an internal outlet slurry pipe".

   iv. Claims 8 – 9 are not clear because, with referable to, "a duct communicating...", 'a duct' lacks proper antecedence as a duct is defined in claim 2.

   v. Claim 13 is not clear because, with reference to recitation, 'The chemical processing apparatus of any one of the preceding claims, including a series of vessels, wherein excess gas duct(s) bypass individual vessels', claims 1- 5 do not define a plurality of vessels and therefore 'excess gas duct(s) bypass individual vessels' is not clear with reference to claims 1 – 5.