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Datasheet for the decision of 12 September 2022

Case Number: T 2026/20 - 3.2.01

Application Number: 11764408.8

Publication Number: 2619406

IPC: E21B36/02, E21B43/16, E21B43/40

Language of the proceedings: EN

Title of invention:
METHOD OF USING CARBON DIOXIDE IN RECOVERY OF FORMATION DEPOSITS

Applicant:
8 Rivers Capital, LLC

Headword:

Relevant legal provisions:
EPC Art. 123(2), 56

Keyword:
Amendments - allowable (yes)
Inventive step - main request (yes) - non-obvious combination of known features

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 2026/20 - 3.2.01

D E C I S I O N
of Technical Board of Appeal 3.2.01
of 12 September 2022

Appellant: (Applicant)	8 Rivers Capital, LLC 406 Blackwell Street, 4th Floor Durham, North Carolina 27701 (US)
Representative:	Hoeger, Stellrecht & Partner Patentanwälte mbB Uhlandstrasse 14c 70182 Stuttgart (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 7 July 2020 refusing European patent application No. 11764408.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Pricolo
Members:	A. Wagner
	S. Fernández de Córdoba

Summary of Facts and Submissions

I. The appeal was filed by the applicant against the decision of the examining division to refuse the European patent application No. 11764408.8 pursuant to Article 97(2) EPC.

II. In the decision under appeal the examining division concluded that the main request (filed with letter dated 11 April 2019) and all three auxiliary requests (filed with letter dated 23 April 2020) did not involve an inventive step pursuant to Article 52(1) and 56 EPC in view of the document

D10: US 4 498 289 A

in combination with general knowledge as e.g. disclosed in

D9: WO 2009/134643 A2 or

D11: US2009/266540 A1

III. With the statement of the grounds of appeal the appellant requested to set aside the decision under appeal and to grant a patent based on the main request underlying the contested decision. As an auxiliary measure, it was requested to grant a patent based on one of the auxiliary requests I to VII filed with the statement of the grounds of appeal.

IV. After a telephone conversation with the rapporteur of the board, the appellant filed a new main request with letter dated 16 March 2022.

V. Following a further telephone conversation with the rapporteur of the Board, the appellant requested with letter of 31 August 2022 to set aside the decision of the Examining Division and to grant a patent based on the main request filed with said letter. As an auxiliary measure, auxiliary requests I to VII filed with the statement of the grounds of appeal were maintained.

VI. The main request comprises two independent claims: a method claim 1 and claim 15 directed to a system. Amendments in claim 1, in claim 15 respectively, compared to the corresponding claim as originally filed are indicated by underlines and strike-through by the board. The feature analysis is also added by the board. The claims read as follows.

Claim 1:

A method for recovering a fuel material deposit from a formation, the method comprising

a) providing a combustion fuel (10) and an oxidant (20) into a ~~transpiration cooled~~ combustor (300) positioned above ground;

b) combusting the combustion fuel (10) to provide a CO_2 containing stream comprising supercritical CO_2;

c) expanding the CO_2 containing stream comprising supercritical CO_2 across a turbine (350) for power generation to form an expanded CO_2 containing stream,

d) injecting at least a portion of the CO_2 containing stream into the formation including the fuel material deposit for recovery such that at least a portion of

the fuel material in the formation and at least a portion of the CO_2 stream flow from the formation and into a recovery well (200), wherein the CO_2 containing stream injected into the formation comprises supercritical CO_2,

e) receiving from the recovery well (206) a recovery stream (251) comprising the fuel material and the CO_2,

f) separating the recovery stream (251) into a recovered gas stream comprising methane and CO_2 and a recovered liquid stream, and

g) directing at least a portion of the recovered gas stream comprising methane and CO_2 to the combustor (300) as at least a portion of the combustion fuel (10).

Claim 15:

A system for generating CO_2 and recovering a fuel material deposit from a formation, the system comprising:

A) a ~~transpiration cooled~~ combustor (300),

B) a combustion fuel supply (10) in fluid connection with the combustor (300);

C) an oxidant supply (20) in fluid connection with the combustor (300);

~~a transpiration coolant supply in fluid connection with the combustor;~~

D) a chamber within the ~~transpiration cooled~~ combustor (300) configured for receiving and combusting the combustion fuel (10) to provide a CO_2 containing stream comprising supercritical CO_2;

E) an injection component that delivers the CO_2 containing stream into the formation including the fuel material deposit such that at least a portion of the fuel material in the formation and at least a portion of the CO_2 stream flow from the formation and into a recovery well (200) as a recovery stream; and

F) one or more processing components for processing the recovered fuel material and CO_2 in the recovery stream to form a recovered gas stream comprising methane and CO_2 and directing at least a portion of the recovered gas stream comprising methane and CO_2 to the combustor (300) as at least a portion of the combustion fuel supply (10);

G) wherein the one or more processing components comprises: an expander that reduces the pressure of the recovery stream and that comprises a power generation turbine; and one or more separation units, wherein the one or more separation units comprises a unit that separates the recovered gas stream from the recovered liquid stream.

Reasons for the Decision

1. Article 123(2) EPC

1.1 In the impugned decision, no objection under Article 123(2) EPC was raised. The board is satisfied that the main request on file meets the requirements of Article

123(2) EPC. The passages referred to in the following statement refer to the A1-publication WO2012/040169 of the application.

1.2 Independent claims 1, 15

1.2.1 Claim 1 of the main request is based on original claims 1, 2, 3, 13, 18, 19, 20 and 25.
Claim 15 of the main request is based on original claims 53 to 57.

1.2.2 The omission of "transpiration cooled" in claim 1 and 15 and correspondingly the omission of the "transpiration coolant" in claim 15 finds a basis on page 8, lines 5 to 7 or page 15, lines 4 to 6. Therein the use of a transpiration cooled combustor is presented as only being an example for a suitable combustor.

1.2.3 The wording "positioned above ground" in feature a of claim 1 is disclosed in original claim 2.

1.2.4 Feature c and the wording "*the CO_2 containing stream injected into the formation comprises supercritical CO_2*" in feature d of claim 1 combine the wording of originally filed claims 3 and 13.

1.2.5 Features e, f and g of claim 1 combine the features of originally filed claims 18, 19, 20 and 25.

1.2.6 Feature G of claim 15 combines the features of originally filed claims 54, 55, 56 and 57, wherein it is specified that (in correspondence to claim 19) the gas stream and the liquid stream are the "recovered" ones.

1.2.7 It is noted that in the method claim 1 the combustor is positioned above ground and it is the CO_2 containing stream provided by the combustor that is expanded across a turbine for power generation (original claims 1 to 3).
In the system of claim 15 the position of the combustor is not defined and it is the recovery stream that is expanded across a turbine for power generation (original claims 53 to 55).

1.3 **Dependent claims 2 to 14, 16**

Claim 2 corresponds to originally filed claim 4.
Claim 3 combines original claims 5 and 6.
Claim 4 combines original claims 7 to 10.
Claim 5 combines original claims 11 and 12.
Claims 6 and 7 correspond to original claims 14 and 21.
Claim 8 combines original claims 22 to 24.
Claim 9 combines original claims 26 and 27.
Claim 10 combines original claims 28 and 29.
Claim 11 combines original claims 30 to 33 (29).
Claim 12 corresponds to original claim 34.
Claim 13 corresponds to original claim 35.
Claim 14 includes the feature "transpiration cooled" combustor originally comprised in claim 1.
Claim 16 combines original claims 58 to 61.

1.4 Finally, the description is amended to bring it into conformity with the wording of the amended claims and to acknowledge the relevant prior art.

2. **Article 56 EPC**

2.1 The board judges that claim 1 and claim 15 involve an inventive step over the cited prior art.

2.2 Closest prior art

2.2.1 The board confirms the examining division's opinion that D10 is suitable for being selected as the closest prior art.

2.2.2 D10 is directed to a largely pollution free CO_2 power cycle (title, column 2, lines 36 to 38) within a power generation system (column 2, lines 15 to 29). A combustion fuel and an oxidant is supplied to a combustor chamber 14 (figure 1, column 6, lines 38 to 42). The combustor 14 provides a CO_2 containing stream comprising CO_2 at a pressure of 3000 psi (column 6, lines 46 to 51), which is according to column 7, lines 65 to 67 a supercritical pressure. This stream is expanded at a power generating turbine 21 (column 7, lines 17 to 23).
The CO_2 generated by combustion may be drawn off by a first valve 38 and used e.g. for injection into viscous oil deposits for enabling enhanced oil recovery (EOR), see column 7, lines 49 to 53. Supercritical CO_2 may be tapped by a second valve V for use in EOR (column 8, lines 2 to 4).

2.2.3 The appellant disputed that D10 is the correct springboard for claim 1 or claim 15. D10 was directed to the purpose of high efficiency power production (column 2, lines 15 to 29, lines 39 to 47), not to a method or a system for recovering a fuel material deposit from a formation.

However D10 proposes in column 7, lines 49 to 53, to use the disclosed power generating system in a system for recovering a fuel material deposit from a formation. Therefore also a system and method according to the designation of claim 1 or claim 15 is disclosed

- even if D10 is not focused on the recovering part.

2.3 Distinguishing features

2.3.1 Claim 1 differs from D10 at least in features f, g, claim 15 at least in features F and G.

2.3.2 D10 does not disclose any detail about what happens with the recovery stream when using the power generating system of D10 for enhanced oil recovery EOR. D10 neither discloses processing components for directing at least a portion of the recovered gas stream back to the combustor (feature g, F) nor a separation unit for separating the recovery stream as defined in feature f or the second part of feature G.

2.4 Technical effect and objective technical problem

2.4.1 The technical effect as formulated by the examining division (decision page 7, third paragraph) is that CO_2 provided by the combustor and injected into the formation is recycled by using the CO_2 containing recovered gas stream from a recovery well as fuel for the combustor.

2.4.2 The problem to be solved is to provide an economical and environmental friendly method and system for enhancing recovery of fossil fuel (A1-publication WO2012/040169, page 4, lines 21 to 27, and page 54, line 30 to page 55, line 3).

2.5 Inventive step

2.5.1 The board judges that the requirements of Article 56 EPC are met.

2.5.2 The board confirms the opinion of the examining division that processing components as e.g. a separation unit for separating the recovery stream to form a recovered gas stream and a recovered liquid stream are implicit in methods or systems for recovering a fuel material deposit which use injected CO_2 (see also A1-publication of the application, page 49, lines 12 to 14: "*Likewise, any CO_2 passing through the formation and into the recovery stream typically must be removed to provide a saleable fossil fuel.*").

2.5.3 The examining division further concluded that the use of the recovered gas stream as at least a portion of the combustion fuel supply, was merely an obvious choice for the skilled person (decision, page 7, last paragraph).
As an example for the skilled person's general knowledge the examining division cited D9, page 7, lines 23 to 27 (in paragraph [0029]). Therein carbon dioxide is injected and then recycled by using a recovered gas stream comprising CO_2 as a fuel for a DSHG (Down Hole Steam Generator).
As a further example D11, paragraph [0027] and figure 1, was cited. Therein the recovered gas stream 116 partly is reused as fuel gas (118, 121) for a combustor 110 positioned above ground.

2.5.4 The board does not agree. Starting from D10, it is not obvious to direct a recovered gas stream comprising methane and CO_2 back to the combustor 14.

2.5.5 The system of D10 is adapted to provide power and to lead back the exhaust from the combustor to the same combustor without prior injecting the CO_2-comprising stream into the formation. Thus the combustor is already in connection with a recycled CO_2-stream to

minimize pollution. To improve the known method or system with regard to economic or environmental aspects at the recovery side, which is not described at all in D10, the skilled person has various possibilities.

2.5.6 **D11** strives to achieve the same technical problem as the application in suit (paragraph [0016]:"*There is a need in society for an in-situ combustion oil recovery process that will improve the economics, improve the oil recovery, reduce the environmental impact, and improve safety.*"). To solve the problem posed, D11 (see figure 1 with paragraphs [0027], [0028] and [0033]) discloses that the recovered gas stream 116 is separated once more at separator 117 into a high LHV (Lower Heating Value) fuel gas stream 118 and a stream 119 that is predominantly composed of CO_2. In D11, only the purified high LHV gas 121 is reused as fuel gas for the combustion device 110.
The recovered CO_2-stream 119 however is combined with the CO_2-stream 127 being already a combustion product. Thus the recovered CO_2-stream 119 is re-used directly for injection into the formation (see figure 1: via compressor 129 and stream 130 into injection wells 108a, 18b).
Thus, contrary to the examining division's opinion (decision page 9, 4th paragraph), D11 does not prove a general knowledge that a portion of the recovered gas stream comprising methane and CO_2 is re-used as a portion of the fuel supply for the combustor.

2.5.7 Combining the teaching of D11 with the disclosure of D10 would lead the skilled person to a system wherein a recovered gas stream comprising CO_2 is re-used for injection into the formation at a point after combustion e.g. after the CO_2 is drawn off by valve 38 or V. This would also prevent to disturb the already

optimized power generating cycle of D10 (figure 1).

2.5.8 **D9** indeed discloses that a recovered gas stream may be utilized as a fuel for a DHSG (paragraphs [0025], [0029]). However it is not obvious to transfer this general knowledge to the system disclosed in D10 and to simply redirect a recovered gas stream to the combustor 14.

2.5.9 D9 does not deal with the problem posed but is directed to an increased recovery of hydrocarbons (paragraphs [0001], [0020]). To achieve this object, DHSGs are placed in wells to generate and directly inject CO_2 into the formation, not to generate power.

2.5.10 As argued by the appellant, the teaching of D9 is not combinable with D10. D10 is directed to an energy and power generation system wherein CO_2 can be tapped for a wide variety of ancillary uses (column 2, lines 27 to 29). In D9, the DHSG itself has the purpose of CO_2 generation for injection, independently of power generation. The two systems have different functions and different areas of application within an EOR cycle. Picking out the fact that a recovered gas stream can be redirected to a DHSG and implement it in the power generation system of D10 is based on hindsight.

2.5.11 Hence the requirements of Article 56 EPC are met.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

1.1 The case is remitted to the department of first instance with the order to grant a European patent on the basis of the main request:

- Claims:
  1-16 filed with letter dated 31 August 2022

- Description
  - pages 5, 7, 9, 11, 12, 14, 18, 22, 26, 30-34, 39, 41-43
    filed with letter dated 31 August 2022
  - pages 1, 4, 8, 10
    filed for the Main request with letter dated 23 April 2020
  - page 1a
    filed with letter dated 11 April 2019
  - pages 5a, 20, 20a, 25, 25a
    filed with letter dated 8 September 2014
  - pages 2, 3, 6, 13, 15-17, 19, 21, 23, 24, 27-29, 35-38, 40, 44-57
    as originally filed

- Figures
  1 - 4 as originally filed

The Registrar: The Chairman:

A. Vottner G. Pricolo

Decision electronically authenticated