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**Datasheet for the decision
of 6 October 2022**

Case Number: T 0981/19 - 3.3.05

Application Number: 14853394.6

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Language of the proceedings: EN

Title of invention:
CO2 RECOVERY DEVICE

Applicant:
Mitsubishi Heavy Industries Engineering, Ltd.
The Kansai Electric Power Co., Inc.

Headword:
CO2 RECOVERY DEVICE / Mitsubishi et al.

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

Keyword:
Amendments - allowable (no)
Inventive step - obvious alternative

Decisions cited:

Catchword:



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Case Number: T 0981/19 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 6 October 2022

Appellant: Mitsubishi Heavy Industries Engineering, Ltd.
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 7 December 2018
refusing European patent application No.
14853394.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman E. Bendl
Members: J. Roider
R. Winkelhofer

Summary of Facts and Submissions

- I. The appeal lies from the decision of the examining division to refuse the patent application under Article 56 EPC.
- II. The following document served as the closest prior art in the decision under appeal and is also of relevance here:
- D3 DE 10 2011 108 308 A1
- III. In the communication under Article 15(1) RPBA, the board expressed the opinion, *inter alia*, that the requests on file did not comply with the requirements of Articles 84 and 123(2) EPC. These objections were raised for the first time in the appeal proceedings.
- IV. With a response to this communication dated 3 August 2022, the appellants filed a new main request and new auxiliary requests 1 and 2, in an attempt to overcome the new objections.
- V. Claim 1 of the main request reads as follows:
"A CO₂ recovery unit (10) comprising:
a CO₂ absorber (13) in which a CO₂ -containing gas (11) comes into contact with a CO₂ absorbent (12) to remove CO₂;
an absorbent regenerator (15) which is divided into at least two stages and in which a CO₂ -absorbed rich solution (14) is regenerated by a regenerating heater (31), thereby reusing a lean solution (16), in which CO₂ has been removed in the absorbent regenerator (15), in the CO₂ absorber (13) as the CO₂ absorbent (12);

a rich solution supply line (L_1) through which the rich solution (14) is supplied to the absorbent regenerator (15) from the CO_2 absorber (13);

a lean solution supply line (L_2) through which the lean solution (16) is supplied to the CO_2 absorber (13) from the absorbent regenerator (15);

a lean-rich solution heat exchanger (17) that is provided at an intersection of the lean solution supply line (L_2) and the rich solution supply line (L_1) to exchange heat between the lean solution (16) and the rich solution (14);

characterized by comprising a branch portion (18) that branches some of the rich solution (14a) at a downstream side of the lean-rich solution heat exchanger (17) on the rich solution supply line (L_1);

a line mixing portion (20A) that mixes the some of the rich solution (14a) branched at the branch portion (18) with a semi-lean solution (19) in which CO_2 has been partially removed from the rich solution (14) in the absorbent regenerator (15);

a solution storage portion (21a) of the semi-lean solution (19) located at an upper stage of the absorbent regenerator (15);

a semi-lean solution extracting line (L_4) through which the semi-lean solution (19) is extracted from the solution storage portion (21a) of the semi-lean solution (19) to be supplied to a lower stage side of the absorbent regenerator (15),

wherein a front end of a branch line (L_3) through which the some of the rich solution (14a) is supplied is connected to the semi-lean solution extracting line (L_4) to form the line mixing portion (20A);

and a lean and semi-lean solution heat exchanger (51) that is provided at an intersection of the lean solution supply line (L_2) and the semi-lean solution extracting line (L_4), at an upstream side of the lean-

rich solution heat exchanger (17) interposed on the lean solution supply line (L₂), wherein after the some of the branched rich solution (14a) and the semi-lean solution (19) are mixed with each other in the mixing portion (20A), the mixed solution exchanges heat with the lean solution (16)."

Dependent claim 2 of the main request reads as follows (with the amendments over dependent claim 5 as originally filed being marked):

"The CO₂ recovery unit (10) according to claim 41, comprising a steam condensate heat exchanger (52A, 52B) that is interposed at a downstream side of the line mixing portion (20A) on the semi-lean solution extracting line (L₄) to heat the mixed solution of the some of the branched rich solution (14a) and the semi-lean solution (19) using residual heat of steam condensate (35)."~~from a regenerating heater (31) of the absorbent regenerator (15).~~"

VI. Claim 1 of auxiliary request 1, which is the only claim in this request, combines claims 1 and 2 of the main request.

VII. Claim 1 of auxiliary request 2, which is the only claim in this request, is based on auxiliary request 1 with the addition at the end of the claim of the following:

", the first steam condensate heat exchanger (52A) being in series with the first lean and semi-lean solution heat exchanger (51A), the second steam condensate heat exchanger (52B) being in series with the second lean and semi-lean solution heat exchanger (51B) on the second semi-lean solution extracting line (L₆), the semi-lean solution (19) using residual heat of steam condensate (35) from a regenerating heater (31) of the absorbent regenerator (15)."

VIII. The appellants' arguments can be summarised as follows:

Article 56 EPC

D3 was considered to be the closest prior art. The subject-matter of claim 1 differed in that it required an additional heat exchanger (shown in the application in Fig. 3, ref. 17) for exchanging heat between the cold rich solution from the absorber with the hot lean solution from the regenerator.

It was acknowledged that the equilibrating of the CO₂ dissipation load was also shown in D3. The problem to be solved was thus to save energy.

A heat exchanger with a function similar to heat exchanger 17 of Fig. 3 of the application in suit was not suggested in D3. Moreover, even if the skilled person were to add an additional heat exchanger, D3 did not suggest its position. Other potential positions for a heat exchanger existed, for example in the streams with reference numbers 4 and 5b in Fig. 2 of D3. Therefore, the skilled person was not led to the solution proposed by the subject-matter of claim 1.

Article 123(2) EPC

The amendment in claim 2 of the main request originated from the embodiment shown in Fig. 4 and was disclosed in paragraph [0035] of the description as originally filed. It was, however, acknowledged that paragraph [0035] also disclosed that the second semi-lean solution heat exchanger was operated with steam condensate of a regenerating heater.

- IX. The appellants requested that the impugned decision be set aside and that a patent be granted on the basis of the main request, or on the basis of a 1st or 2nd auxiliary request, all as submitted on 3 August 2022.

Reasons for the Decision

1. Main request - Article 56 EPC, inventive step
- 1.1 The patent application is directed to a CO₂ recovery unit comprising an absorber and an absorbent regenerator.
- 1.2 The appellant considered D3 to be the closest prior art. This document discloses a CO₂ recovery unit comprising an absorber and an absorbent regenerator.
- 1.3 The problem to be solved, according to the appellant, was to provide energy savings.
- 1.4 However, D3 aims at energy savings by way of heat exchange (paragraphs [0013] and [0014]) and provides a solution for this. No evidence was submitted by the appellant that the presently claimed system saves more energy than that of D3.
- 1.5 The problem as stated by the appellant must hence be reformulated as a less ambitious problem, i.e. the provision of an alternative device.
- 1.6 As already stated by the examining division with reference to D3, Fig. 1, the lean solution exiting the heat exchanger 21 needs to be further cooled and could be cooled by exchanging heat with the rich solution exiting the absorber, thus evidently achieving energy

savings.

- 1.7 The appellant argues that the skilled person would not consider this option since this would jeopardise the advantage of conducting the cold rich solution to the top of the regenerator so as to avoid separate water-condensing equipment.
- 1.8 Indeed, D3 also aims at minimising the heat exchange surface (paragraph [0014]). According to the solution in D3, Fig. 2, condenser 18 of Fig. 1 is avoided, which, however, results in a larger heat exchanger 17 for cooling the stream 11 (paragraph [0030]). D3, paragraph [0034], discloses that pre-heating stream 3 reduces the required heat exchange surface of heat exchanger 21. Evidently if stream 11 was already cooled to some extent upstream of heat exchanger 17, the required heat exchange surface for heat exchanger 17 would also be reduced. The skilled person would thus see a potential reduction of the heat exchanging surface of two heat exchangers just by adding one further heat exchanger.

A temperature of stream 4 above which condenser 18 cannot be avoided is not disclosed.

A disclosure which would discourage the skilled person from adding a heat exchanger in stream 3 between the bottom of the absorber and valve 24 for exchanging heat with stream 11 upstream of heat exchanger 17 is thus not apparent.

- 1.9 The appellant argues that the skilled person had several possibilities for positioning a heat exchanger.

- 1.10 It should once again be stressed here that the problem to be solved is to provide an alternative device. As mentioned above, the appellant could not provide data which showed an improvement beyond what the skilled person expected in view of D3.

When providing an alternative to the process disclosed in D3, Fig. 2, the skilled person would therefore immediately also consider a heat exchange between streams 11 and 3, as shown in Fig. 2 of D3, and thus a configuration as according to the claimed subject-matter.

No inventive step can thus be acknowledged.

2. Main request - Article 123(2) EPC, amendments

- 2.1 The feature "*from a regenerating heater (31) of the absorbent regenerator (15)*" was deleted from claim 2.

The deleted features require that the unit contained a regenerating heater and a connection to the semi-lean solution heat exchanger for the condensate. Moreover, the condensate emanating from the condensation process of a steam-operated regeneration heater can only be used as a heating medium in the semi-lean solution heat exchanger if it is designed accordingly. With the deletion, this design is no longer implied.

The original application did not, however, disclose a unit without these features.

The parts of the description using the feature "*steam condensate*" relate to prior art (page 2), include the

reference to the regeneration heater (page 5, original claim 5), or relate to the description of Figures 4 and 5 (pages 9 and 14-17), both of which show a connection from the condensate separator of the steam-operated regeneration heater to semi-lean solution heat exchanger 51.

The subject-matter of dependent claim 2 of the main request thus infringes Article 123(2) EPC.

3. Auxiliary request 1 - Article 123(2) EPC, amendments

Since the subject-matter of claim 1 originates from a combination of claims 1 and 2 of the main request, auxiliary request 1 does not comply with the requirements of Article 123(2) EPC for the same reasons as dependent claim 2 of the main request.

4. Auxiliary request 2 - Article 123(2) EPC, amendments

Auxiliary request 2 was first filed with the statement of grounds of appeal and was thus not dealt with in the decision under appeal.

Notwithstanding the question of admission under Article 12(4) RPBA 2007, the subject-matter of claim 1 originates from a combination of claims 1 and 2 of the main request, and further requires a second steam condensate heat exchanger. The presence of the second steam condensate heat exchanger does not compensate for the deletion of the feature "*from a regenerating heater (31) of the absorbent regenerator (15)*".

Auxiliary request 2 therefore does not comply with the requirements of Article 123(2) EPC for the same reasons as dependent claim 2 of the main request.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



C. Vodz

E. Bendl

Decision electronically authenticated