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**Datasheet for the decision
of 10 February 2021**

Case Number: T 2293/17 - 3.3.10

Application Number: 09803318.6

Publication Number: 2318336

IPC: C07C7/04

Language of the proceedings: EN

Title of invention:

HIGH ENERGY REDUCTION IN A PROPANE DEHYDROGENATION UNIT BY
UTILIZING A HIGH PRESSURE PRODUCT SPLITTER COLUMN

Applicant:

Lummus Technology Inc.

Headword:

Relevant legal provisions:

EPC Art. 123(2), 56, 111(1)

Keyword:

Inventive step - after amendment (yes)

Decisions cited:

Catchword:



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Case Number: T 2293/17 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 10 February 2021

Appellant: Lummus Technology Inc.
(Applicant) 1515 Broad Street
Bloomfield, NJ 07003-3096 (US)

Representative: Serjeants LLP
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75 Exploration Drive
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 9 May 2017
refusing European patent application No.
09803318.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair P. Gryczka
Members: R. Pérez Carlón
W. Van der Eijk

Summary of Facts and Submissions

- I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 09803318.6 due to lack of inventive step.
- II. The documents relevant for the present decision are the following:

- D1 High Performance Trays and Heat Exchangers in Heat Pumped Distillation Columns, M.W. Wisz et al. Proceedings from the Third Industrial Energy Technology Conference Houston, TX, April 26-29, 1981, pages 91-96
- D2 US 3,968,030
- D3 US 5,720,929

- III. In response to the board's communications, the appellant filed with a letter dated 16 December 2020 a new main request, whose claim 1 reads as follows:

"A process for separation of an olefin from a paraffin in a product stream from a dehydrogenation system having a steam turbine driven dehydrogenation reactor product compressor, comprising the steps of:

feeding a stream comprised of a mixture of an olefin and a paraffin to a product splitter column having a product splitter column reboiler to produce an overhead stream and a bottoms stream;

splitting the bottoms stream into a recycle stream and a return stream;

splitting the bottoms return stream into a first bottom return stream and a second bottom returns stream

and feeding the first bottoms return stream to the product splitter column reboiler;

feeding the second bottoms return stream to a heat exchanger;

heating the second bottoms return stream by heat exchange contact with a refrigerant circulated through a refrigerant loop having a steam turbine driven refrigeration compressor;

feeding the heated second bottoms return stream to the product splitter column; and

feeding the exhaust steam from the steam turbine driven dehydrogenation reactor product compressor and the exhaust steam from the steam turbine driven refrigeration compressor to the product splitter column reboiler to provide heat to the product splitter column."

- IV. The appellant argued that claim 1 of the main request found a basis in the combination of claims 1 and 6 as originally filed.

The claimed process required splitting the bottoms return stream, and specific heat transfer steps. Even if the claimed invention were to be considered as the mere provision of an alternative process, the claimed solution, characterised by splitting the bottoms return stream and heating by means of steam and refrigerant arising from compressors in the specific manner required by claim 1, would not have been obvious for the skilled person and was thus inventive.

- V. The final request of the appellant, in writing, is that the decision under appeal be set aside and the case be remitted to the examining division with the order to grant a patent with the claims of the main request filed with a letter dated 16 December 2020, or with the

claims of the first auxiliary request as filed with a letter of 18 November 2020.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. Amendments

- 2.1 Claim 1 finds a basis in the combination of claims 1 and 6 as originally filed.

Claim 6 as originally filed required "feeding the exhaust steam from the steam turbine refrigeration compressor to the product splitter column reboiler to provide heat to the first bottoms return stream. In contrast, claim 1 requires feeding that exhaust steam to the same point (the product splitter column reboiler), but in order to provide heat "to the product splitter column".

In the context of chemical engineering, reboilers are devices to provide heat to distillation columns. The amendment thus does not add any information not originally disclosed to the skilled reader, as heating a reboiler inevitably provides heat to the corresponding column.

- 2.2 Claims 2 to 5 find a basis on claims 7 to 10 as originally filed. Lastly, claim 6 is based on claim 11 as filed with the added feature "prior to splitting the overhead stream into the product stream and the reflux stream", which finds a basis on paragraph [0016] of the

application as originally filed.

3. Novelty

The examining division considered the subject-matter of the claims before it novel. The board sees no reason to differ with respect to claim 1 of the main request in this appeal proceedings, which relates to a process more limited in scope than that of the claims before the examining division.

4. Inventive step

4.1 Claim 1 relates to a process for the separation of an olefin from a paraffin, in a dehydrogenation process, by means of a splitter column.

The process includes dividing the bottoms of the column into a recycle stream (i.e. a stream which could be recycled to the dehydrogenation process) and a return stream, (i.e. a stream to be reintroduced into the splitter column). The return stream is further split into a first and a second return stream. The first stream is sent to the reboiler.

The system includes two steam turbine driven compressors, namely a refrigeration compressor and a dehydrogenation reactor product compressor. The refrigerant of the former heats the second bottom return stream, by heat exchange contact. The exhaust steam of both compressors are fed to the reboiler to heat the splitter column.

4.2 The examining division considered document D1 to be the closest prior art. The appellant did not disagree and the board sees no reason to differ. In particular, the

embodiment disclosed in the abstract of document D1, reflected in paragraphs [0004] to [0010] and Figure 2 of the application as originally filed, is the closest prior art.

According to this embodiment (see Figure 2 of the application), product splitter reboiler (120) is heated with compressed overhead vapour steam (102) arising from heat pump (130). Exhaust steam of the heat pump is cooled and discharged from the plant.

4.3 The technical problem underlying the claimed invention is to provide an alternative process for the separation of an olefin from a paraffin in a product stream from a dehydrogenation system.

4.4 The claimed solution is the process of claim 1, characterised by

- splitting the bottoms return stream into a first and second bottom streams
- feeding the first to the reboiler
- feeding the second to a heat exchanger, heating it with the refrigerant from a steam turbine driven refrigeration compressor and feeding it to the column, and
- heating the reboiler with steam arising from two steam turbine driven compressors, namely a dehydrogenation reactor product compressor and the refrigeration compressor whose refrigerant heats the second bottoms return stream.

4.5 There is no doubt that the claimed process provides an alternative for separating an olefin from a paraffin and thus that the problem as formulated in point 4.3 above is credibly solved by the process of claim 1.

4.6 The available prior art does not disclose either the required pathway of the bottom stream nor the use of steam from turbine driven compressors for heating the reboiler, let alone using the steam arising from the specific ones required by claim 1. It would thus not have provided a hint towards the claimed solution.

D2 discloses using steam to improve the energy balance of a petroleum refinery (claim 1). It neither discloses nor hints at the separation of the bottom return of the distillation column in two streams, nor at the specific heating pathway required by claim 1.

Document D3 relates to the catalytic dehydrogenation of a paraffin and its purification. On column 6, lines 47-60, it discloses the need of a compression system, which can be, among others, a steam turbine (column 6, line 59). It does not disclose or hint at the use of that steam for heating the column reboiler as required by claim 1. It does not disclose the separation of the bottom return stream into two feeds, or the specific mode of heating required by claim 1.

The claimed solution would thus not have been obvious for a person skilled in the art and is therefore inventive (Article 56 EPC).

5. Remittal

The description of the application contains subject-matter not encompassed by the claims (see for example

[0017] and [0018]) and thus requires amendment (Article 84 EPC). The board decided to make use of its discretion to remit the case to the examining division for the description to be adapted (Article 111(1) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the examining division with the order to grant a patent with claims 1 to 6 of the main request as filed on 16 December 2020 and a description and drawings yet to be adapted.

The Registrar:

The Chair:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated