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**Datasheet for the decision
of 14 May 2008**

Case Number: T 0141/06 - 3.3.05

Application Number: 98953286.6

Publication Number: 1129031

IPC: C01C 3/02

Language of the proceedings: EN

Title of invention:

Improved process for cyanic acid production

Patentee:

L'AIR LIQUIDE, Société Anonyme pour l'Etude et l'Exploitation
des Procédés George Claude

Opponent:

Linde Aktiengesellschaft, Wiesbaden

Headword:

Hydrogen cyanide production/AIR LIQUIDE

Relevant legal provisions:

EPC Art. 56

Relevant legal provisions (EPC 1973):

-

Keyword:

"Inventive step (no): juxtaposition of known processes"

Decisions cited:

-

Catchword:

-



Case Number: T 0141/06 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 14 May 2008

Appellant: Linde Aktiengesellschaft, Wiesbaden
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
30 November 2005 concerning maintenance of
European patent No. 1129031 in amended form.

Composition of the Board:

Chairman: G. Raths
Members: J.-M. Schwaller
S. Hoffmann

Summary of Facts and Submissions

I. This appeal was lodged by the opponent (hereinafter "the appellant") against the interlocutory decision of the opposition division maintaining the European patent No. 1129031 in amended form on the basis of the main request submitted on 13 October 2005 during the oral proceedings before the first instance, claim 1 of which reads as follows:

"1. A process for the production of hydrogen cyanide by reacting methane, ammonia and oxygen in the presence of a catalyst, the process comprising
(i) establishing a temperature for the catalyst in the reaction using air as a source for oxygen, and
(ii) providing additional oxygen to the reaction to provide oxygen enrichment of the reaction feed, while also adjusting the amount of ammonia and methane reactants in the reaction feed such that the volume percent of the ammonia and methane is above the upper flammability limit and the temperature of the catalyst is within 50°C of the temperature of the catalyst established in (i)."

II. The parties relied upon *inter alia* the following documents during the opposition procedure:

D1: GB-A-1 120 401

D2: J. Haber, Selectivity in heterogeneous catalytic oxidation of hydrocarbons, American Chemical Society, 1996, pages 20 to 21

D3: US-A-4 128 622.

III. In the contested decision, the opposition division concluded that the claimed process involved an inventive step. The reasoning was in essence as follows:

In D1 - which represented the closest prior art - the source of oxygen used for the production of hydrogen cyanide was either air or oxygen-enriched air, whereby the claimed process initially used air and then oxygen-enriched air.

While temperatures of about 1100°C, similar to those used in the examples of the patent-in-suit, might be selected in D1 for the examples in which oxygen-enriched air was used, no side-by-side comparison with said examples was made by the Opponent in terms of yield, selectivity and heat duty requirements. The opponent had argued that the same effects were achieved in the patent in suit and that no problem was solved by the claimed process. However these arguments could not be retained for showing lack of inventive step since no evidence was provided to this end and even if the subject-matter claimed was an alternative process to the one of D1, regarding the question whether the claimed alternative would be an obvious solution for those skilled in the art, its arguments were mainly based on an "ex post facto" analysis as no stepwise enrichment in oxygen was suggested in document D1. Furthermore, the document D2 did not concern the catalysts used in the specific field of the invention and did not suggest any stepwise enrichment by oxygen, even if it pointed out the well-known dangers associated with catalyst overheating. Document D3 suggested a fully different route for establishing the

preferred reaction conditions, this route being however based on using the same source of oxygen throughout the process.

- IV. In its grounds of appeal dated 28 March 2006, the appellant held that the subject-matter of claim 1 as maintained by the opposition division lacked an inventive step over D1 in combination with elementary technical knowledge.
- V. The respondent (also patent proprietor) did not come forward during the appeal proceedings and as announced in its letter dated 27 March 2008, it did not attend the oral proceedings which took place on 14 May 2008.
- VI. The appellant argued at the oral proceedings that the subject-matter of claim 1 on file lacked an inventive step over the disclosure of D1, in particular the Examples thereof.
- VII. The appellant requested that the decision under appeal be set aside and that the patent be revoked.

The respondent did not submit any request.

Reasons for the Decision

- 1. *Interpretation of claim 1*
 - 1.1 Claim 1 as maintained in the contested decision concerns a two-step process, which requires air and oxygen-enriched air in its steps (i) and (ii), respectively.

- 1.2 The description of the contested patent, in particular paragraphs [0018] and [0029], reveals that said process has "applicability to existing plants which need to be improved with regard to hydrogen cyanide production", in which case, "the existing plant would already have established a fixed gauze temperature, from which the appropriate adjustments can be made in accordance with the present invention".

As further indicated in paragraph [0016] of the patent in suit, said process "comprises first establishing a temperature for the catalyst in the reaction using air as a source for oxygen. This essentially establishes the gauze temperature of the plant. Additional oxygen is then provided to the reaction to provide oxygen enrichment of the reaction feed ..."

- 1.3 From the above excerpts, it can be concluded that step (i) as defined in present claim 1 - which reads "*establishing a temperature for the catalyst in the reaction using air as a source for oxygen*" - is nothing other than carrying out a process for catalytically producing hydrogen cyanide by reacting methane, ammonia and oxygen in an "existing plant", i.e. in a plant running with air as the source for oxygen, and identifying the temperature of the catalyst in this process.

2. *Inventive step of claim 1*

- 2.1 In accordance with the "problem-solution approach" applied by the boards of appeal, it is necessary to establish the closest state of the art, to determine in

the light thereof the technical problem addressed by the alleged invention and that the latter successfully solves, and finally to examine the obviousness of the claimed solution to this problem in view of the state of the art. The respondent did not make any submissions to this issue.

2.2 In agreement with both the appellant and the contested decision, the board takes document D1 as the closest state of the art, as it concerns - like the contested patent - a process for producing hydrocyanic acid (i.e. hydrogen cyanide) with high conversions and yields at high temperature, by a gas phase reaction of ammonia with methane, nitrogen and oxygen in the presence of a catalyst comprising platinum, rhodium or iridium or their alloys (D1, page 1, lines 8 to 15 and 68 to 75). In particular, the process according to Examples 4, 5 or 6 of document D1 is taken as the starting point for the assessment of an inventive step.

2.3 The process of D1 comprises (see page 2, lines 2 to 19) preparing a preheated mixture of ammonia, methane, nitrogen and oxygen, at 200 to 400°C, and passing said preheated mixture into contact with a catalyst comprising platinum, rhodium or iridium or an alloy thereof, at a temperature lying preferably in the range of from 1100 to 1200°C, whereby the mixture has a composition satisfying the following molar proportions:

- (a) oxygen to oxygen plus nitrogen is above 0.21 and not more than 0.35,
- (b) oxygen plus nitrogen to ammonia is from 6 to 2,
- (c) oxygen plus nitrogen to methane is from 6 to 1.6,
- (d) methane to ammonia is from 1.3 to 1.0.

In its six Examples - the results of which are summarized in the next Table - the process works at a catalyst temperature of 1120°C to 1150°C (page 2, lines 120 to 128).

Example	Preheating temperature	percentage of gases in the feeding mixture % vol				ratio of the flow rates of gases by volume				HCN in the outlet gases	Conversion of NH ₃ into HCN %	Yield on the converted NH ₃ %
		N ₂	NH ₃	CH ₄	O ₂	$\frac{O_2}{O_2+N_2}$	$\frac{O_2+N_2}{NH_3}$	$\frac{O_2+N_2}{CH_4}$	$\frac{CH_4}{NH_3}$			
1	110	59.5	10.7	14	15.8	0.21	7	5.4	1.3	7.5	68	80
2	110	54.0	12.4	16	17.6	0.245	5.78	4.47	1.3	9.2	70	82
3	300	57.0	13	15	15	0.21	5.5	4.80	1.15	9.9	71	83
4	300	49.8	16	18	16.2	0.245	4.12	3.66	1.13	12.8	73.5	85.5
5	300	50.6	16	17	16.4	0.245	4.18	3.94	1.06	13.1	75	91.0
6	300	46.8	16	19.1	18.1	0.28	4.05	3.40	1.19	13.4	76	92

2.4 The process run in Examples 1 to 3 - which was used for comparative purposes in the context of the teaching of D1 - differs from those according to Examples 4 to 6 in particular by the $O_2/(O_2 + N_2)$ ratio and/or by the preheating temperature.

Specifically, in Examples 1 and 3, use is made of air ($O_2/O_2 + N_2 = 0.21$) as the source for oxygen in the reaction feed. In the light of the interpretation of claim 1 (see item 1.), the process of these Examples are thus comparable to the "existing plants" described in paragraphs [0018] and [0029] of the contested patent as "needing to be improved" and "already having established a fixed gauze temperature". The process of Examples 1 and 3 thus falls under the wording of present claim 1, step (i).

2.5 In contrast, the process according to Examples 4 to 6 makes use of oxygen-enriched air as the source for oxygen ($O_2/O_2 + N_2 = 0.245, 0.245$ and 0.28 , respectively)

and as well as of amounts of ammonia and methane in the reaction feed which differ from those used in Examples 1 and 3. Said process is moreover carried out under conditions of maximum safety with regard to the inflammability of the gaseous mixture (D1, page 2, lines 66 to 108) and at a catalyst temperature which lies in the same range of 1120°C to 1150°C as in Examples 1 and 3, i.e. within a maximum of 30°C of the temperature "established" in the process of Examples 1 or 3. In view of these findings, it can be concluded that the process disclosed in Examples 4, 5 or 6 fits with the wording of step (ii) defined in present claim 1.

- 2.6 As regards the problem to be solved, it was defined in the patent in suit as the provision of a process for optimizing the production, capacity and selectivity in existing hydrogen cyanide plants, without sacrificing safety or catalyst performance (see in particular paragraphs [0011] to [0014]). However, as the patent in suit did not consider D1 as a relevant background art, the problem to be solved has to be assessed in the light of this document.

In this respect, D1 discloses a process which is safe as regards the inflammability of the gaseous mixture and which affords high conversions to, and yields of, hydrogen cyanide as well as high concentrations of hydrogen cyanide in the exit gases (page 2, lines 20 to 28 and 66 to 70). Furthermore, in its Examples, D1 works at a catalyst temperature of 1120 to 1150°C, i.e. a range of temperature which is narrow enough for not substantially affecting the performance and durability of the catalyst used.

A detailed comparison of Example 3 with Examples 4, 5 or 6 of D1 reveals a 29.9 to 35.4% increase of HCN in the outlet gases in favour of the which use oxygen-enriched air in the feed gas (Examples 4 to 6); these results are comparable with the increase of HCN registered in Examples 2 and 3 of the patent in suit (33 and 34%, respectively).

In consequence, it can be concluded that the process carried out in the Examples 4 to 6 of D1 provides for the same advantages as the one presently claimed.

Therefore, the problem to be solved in the light of D1 must be reformulated in less ambitious terms, namely as the provisions of **an alternative** process for producing hydrogen cyanide by reacting methane, ammonia and oxygen in the presence of a catalyst.

- 2.7 The Examples 1 to 5 of the contested patent show that this problem is effectively solved by the process according to claim 1.
- 2.8 The question which remains to be answered is whether the proposed solution as presently defined in claim 1 would have been obvious in the light of the prior art.
- 2.9 The subject-matter of claim 1 as maintained in the contested decision distinguishes from the process illustrated in the Examples 4 to 6 of document D1 in that a step (i) is conducted before step (ii).

- 2.10 As indicated in item 2.4 *supra*, Examples 1 or 3 of D1 disclose a process for producing hydrogen cyanide according to step i) of present claim 1.

As this process works in conditions of maximum safety (page 2, lines 66 to 70) and is performed in the same plant, on the same catalyst and within the same range of catalyst temperatures (1120 to 1150°C) as the process of Examples 4 to 6, the skilled person will easily realize that the different processes exemplified in D1 can be run consecutively.

- 2.11 Under these circumstances, and as D1 contains no information which might deter the skilled person from running the process of Example 1 or 3 previously to the one according to Example 4, 5 or 6, the skilled person starting from the process disclosed in Example 4, 5 or 6 and faced with the problem of providing an alternative process thereto has thus good reasons to juxtapose these two processes and end with the two step process claimed, i.e. start with step (i) according to Example 1 or 3 and continue with step (ii) according to Examples 4, 5 or 6.

As to the mere fact that the combination of the above two steps is not described in the prior art document D1 is per se not enough to substantiate an inventive step, in view of the above findings, the board concludes that the subject-matter of claim 1 is obvious in the light of D1.

Claim 1 as maintained in the contested decision therefore lacks an inventive step under Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

D. Magliano

G. Raths