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Datasheet for the decision of 27 May 2025

Case Number: T 1937/22 - 3.3.10

Application Number: 13724000.8

Publication Number: 2844640

IPC: C07C273/04

Language of the proceedings: EN

Title of invention:
UREA PRODUCTION PLANT

Patent Proprietor:
Stamicarbon B.V.

Opponent:
thyssenkrupp Fertilizer Technolgy GmbH

Headword:
UREA/STAMICARBON

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes) - unexpected improvement shown - choice of the document representing the closest prior art

Decisions cited:
T 1841/11, G 0012/91

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 1937/22 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 27 May 2025

Appellant: (Patent Proprietor)	Stamicarbon B.V. Mercator 3 6135 KW Sittard (NL)
Representative:	V.O. P.O. Box 87930 2508 DH Den Haag (NL)
Respondent: (Opponent)	thyssenkrupp Fertilizer Technolgy GmbH Vosskuhle 38 44141 Dortmund (DE)
Representative:	Gulde & Partner Patent- und Rechtsanwaltskanzlei mbB Berliner Freiheit 2 10785 Berlin (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 22 June 2022 revoking European patent No. 2844640 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	P. Gryczka
Members:	M. Kollmannsberger
	L. Basterreix

Summary of Facts and Submissions

I. The patent proprietor appealed the Opposition Division's decision to revoke its patent under Articles 101(2) and 101(3)(b) EPC.

II. The patent relates to a plant for urea production, in particular for the production of solid urea particles. The idea of the patent is to add a second evaporator and a second condenser unit to an otherwise known production plant downstream of the dust scrubbing section. Such a modification leads to less energy consumption in the first evaporation/condensation loop, see paragraph [0020] of the description. The patent claims a plant (claim 1), a method for modification of an existing plant (claim 4), a use of an additional evaporation/condensation loop for the purpose of increasing the capacity of an existing plant (claim 5), and a process for the preparation of urea (claim 6).

III. Independent claim 1 of the patent is worded as follows:

"*A urea production plant comprising a synthesis and recovery section (A); said section being in fluid communication with an evaporation section (B), said evaporation section being in fluid communication with a finishing section (C) and having a gas flow line to a condensation section (E); said finishing section (C) having a gas flow line to a dust scrubbing section (D) wherein said dust scrubbing section (D) is configured for dust scrubbing using a circulating urea solution as washing agent and additionally has a fresh water supply; wherein the plant comprises an additional*

evaporation section (G) placed downstream of the dust scrubbing section (D), and wherein said additional evaporation section (G) is in fluid communication with the finishing section (C); wherein the additional evaporation section (G) has a gas flow line to an additional condensation section (H), and wherein the additional condensation section (H) is in fluid communication with the dust scrubbing section (D)".

Independent claims 4 (method), 5 (use) and 6 (process) contain similar characterizing features referring to the second evaporation and condensation sections (G) and (H). Throughout the opposition proceedings these claims were not treated separately from the plant defined in claim 1.

IV. The following documents are relevant for the present decision:

D8a: Pothoff, "*Jumbo Single-Line Urea Granulation Plants – Ready for implementation*", Nitrogen and Syngas 2011 International Conference and Exhibition

D9: Uhde, Brochure Urea, December 2007

D12: Schmitz, "Emission Control in Urea Plants During Normal Operating and Upset Cases - Why So Many Different Solutions?", Nitrogen and Syngas 2012 International Conference and Exhibition

V. The patent was opposed under Article 100(a) EPC for lack of novelty and inventive step and under Article 100(c) EPC for unallowable amendments. Lack of sufficient disclosure under Article 100(b) EPC was

raised as an additional ground of opposition during oral proceedings before the Opposition Division, but not admitted into the procedure. The patent proprietor defended the patent in unamended form, as well as in amended forms based on auxiliary requests (ARs) 1-4.

VI. The Opposition Division concluded that the patent as granted did not contain unallowable amendments and that the claimed subject-matter was novel. Regarding inventive step the Opposition Division considered D8a as document representing the closest state of the art. Starting from this document the claimed plants and processes lacked inventive step. Also the claims of ARs 1-4 were considered to lack inventive step over D8a.

VII. The Opposition Division's findings on novelty, unallowable amendments and sufficiency of disclosure were uncontested in appeal proceedings.

VIII. The appellant (patent proprietor) submitted that the assessment of inventive step made by the Opposition Division was erroneous. D8a was directed to a different technical problem than the patent and would not have been considered as a starting point by a skilled person when confronted with the problem the patent was trying to solve, i. e. the reduction of energy consumption in a standard urea production plant. A skilled person would rather have started from D9. In any case the claimed urea production plant was likewise not obvious even if using D8a as a starting point.

IX. The respondent (opponent) defended the Opposition Division's decision. The urea production plant and the urea production process disclosed in D8a had more features in common with the claimed plant/process than the one disclosed in D9. In particular, it disclosed the characterizing feature, namely the second evaporation/condensation loop. D8a was from the field of urea production, so it could well be used as a starting point in an inventive step analysis. The Opposition Division correctly found that the claimed urea production plant was obviously derivable from the teaching of D8a.

X. Oral proceedings took place on 27 May 2025.

XI. The appellant requested to set aside the appealed decision and to maintain the patent as granted, or in amended form on the basis of any of auxiliary requests 1 to 4 underlying the appealed decision.

XII. The respondent requested the appeal to be dismissed. The respondent also requested newly filed document D12 not to be admitted to appeal proceedings.

XIII. The decision was announced at the end of the oral proceedings.

XIV. After the oral proceedings were closed, the respondent indicated that it wished the Board to refer a question to the Enlarged Board of Appeal concerning the choice

of the closest prior art document. The Board considered this submission as too late.

Reasons for the Decision

1. The appeal is admissible.

2. The Opposition Division's findings on novelty, unallowable amendments and sufficiency of disclosure were uncontested. Thus, the patent as granted fulfils the requirements of Articles 54, 83 and 123(2) EPC.

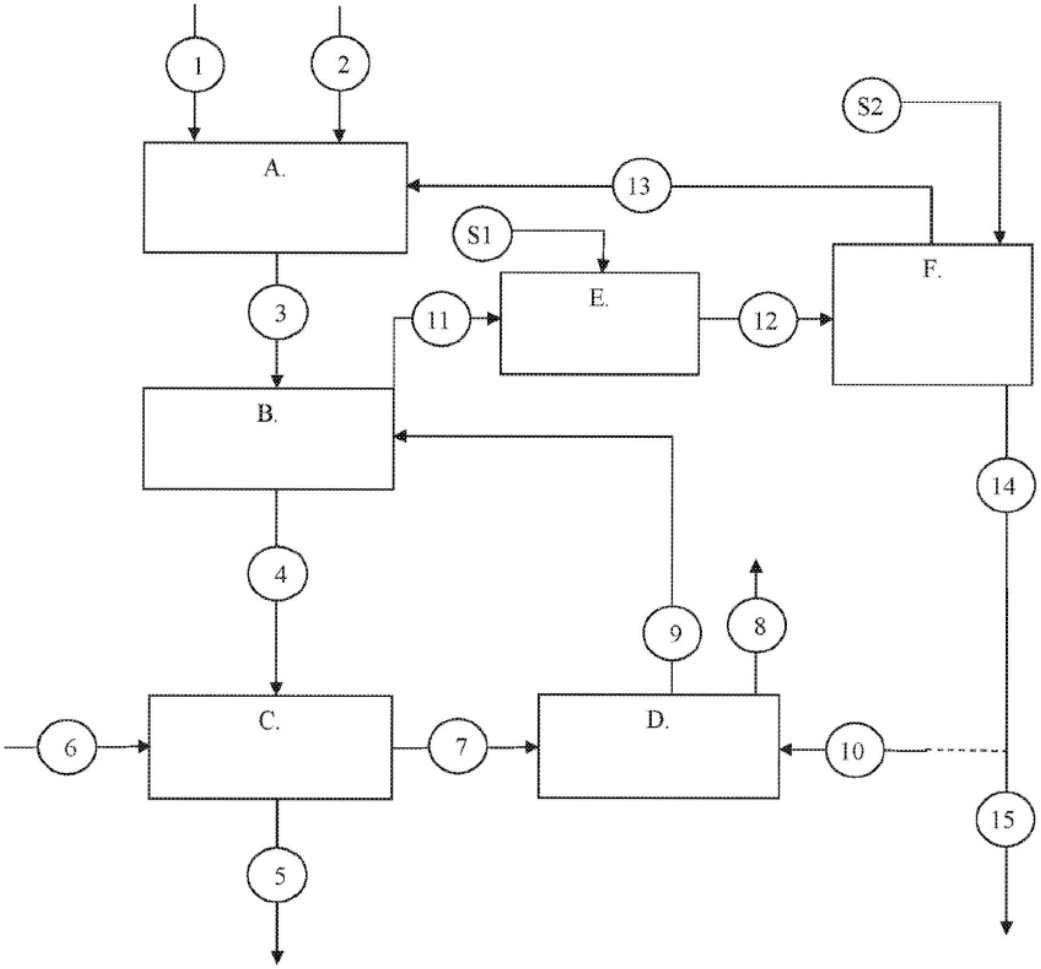
3. The disputed issue is whether the urea production plant claimed in claim 1 of the granted patent and the corresponding processes, methods and uses claimed in the other independent claims involve an inventive step over the prior art, Articles 100(a) and 56 EPC, in particular over documents D8a and D9.

4. The Board finds it useful, in the present case, to summarize the teachings of the patent, of D8a and D9 before discussing the question of which document comes closer to the claimed invention and whether the subject-matter of the patent claims is obvious over these disclosures or not.

5. "Classical process" for urea production as known from D9, and corresponding production plant

5.1 A "classical" process for the production of urea, and a corresponding urea plant, is depicted in figure 1 of

the patent. It was undisputed between the parties that the process and the corresponding plant disclosed in D9 correspond to figure 1 of the patent. Figure 1 is shown here and explained in more detail below:



In this process scheme the product formation is on the left side, from A to C. The product (solid urea) is obtained in stream 5.

5.2 In detail such a process works as follows:

5.2.1 Synthesis section

In the synthesis section (A) urea is produced from ammonia and carbon dioxide. An aqueous urea solution (3) exits the synthesis unit. The solution enters an evaporation unit (B) where it is concentrated to a liquid urea melt. Water and gaseous by-products or unreacted reactants (ammonia, carbon dioxide) are removed via stream (11). The liquid urea melt (4) is transferred to a granulator (C) where it is cooled, solidified and granulated to particles. The particles are the desired product (5).

5.2.2 Upper loop B->E->F->A (recycling of ammonia/carbon dioxide from the evaporation unit B back to the reactor)

Stream 11 contains gaseous water, ammonia and carbon dioxide, and also trace urea. The stream is condensed in condenser E. The resulting aqueous solution is transferred to the condensate treatment section F where it is freed from all contaminants. Urea is hydrolysed to ammonia and carbon dioxide and these gases are stripped from the solution and fed back to the reactor via stream (13). The treatment of the condensate in F, in particular the stripping process, needs a considerable amount of hot steam (S2). Resulting clean water (14) is either disposed of (15) or fed into the dust removal section D (see below) via line (10).

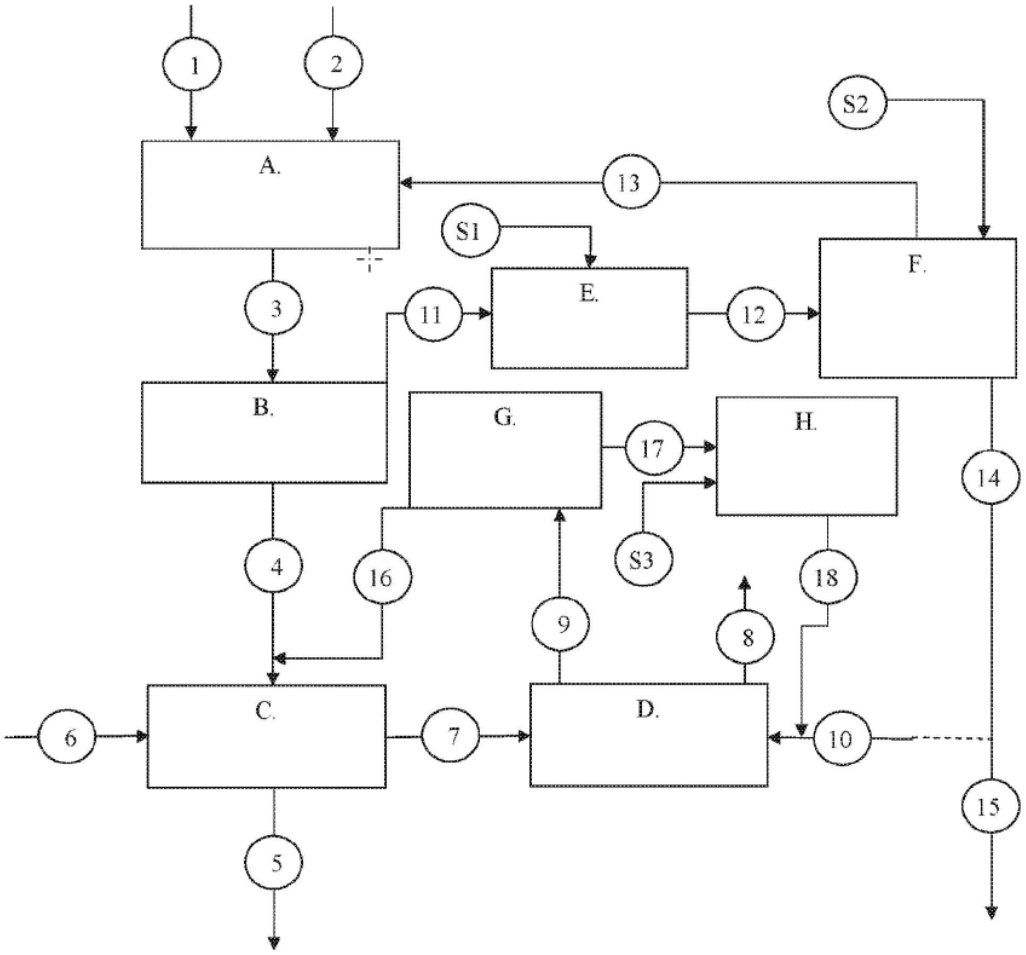
5.2.3 Lower loop C->D->B (dust removal from the granulator)

When cooling the urea melt in the granulator (C) using cooling air (6) the air flow takes some urea dust with it. In the dust removal unit (D) the hot dust containing air is washed with a circulating urea solution, part of which is continuously fed back to the evaporation unit (B) via line (9). Since the arriving

dust containing air is hot, water from the circulating washing solution is partly evaporated and needs to be replaced by fresh water via line (10), possibly from the clean water stream (14). Dust-free air is then released to the atmosphere (8). The replacement water needs to be clean and in particular free from ammonia because otherwise ammonia is also released via (8) to the atmosphere.

6. Process and plant according to the claimed invention

The process according to the claimed invention and the corresponding production plant is shown in figure 2 of the patent. Figure 2 is shown here and explained in more detail below:



The process contains the additional units G and H, and thus a second evaporation/condensation loop D->G/H->C/D:

The washing solution from the dust scrubber (D), instead of being fed back to the main line evaporator (B) (see above in the classical process), is transferred to a second evaporator (G) via line (9), where it is split into a urea melt and a gas stream. The urea melt is fed via line (16) to granulator (C) together with the main stream (4). The off-gases are condensed in the second condenser H. The resulting water stream (18) is essentially ammonia-free and can

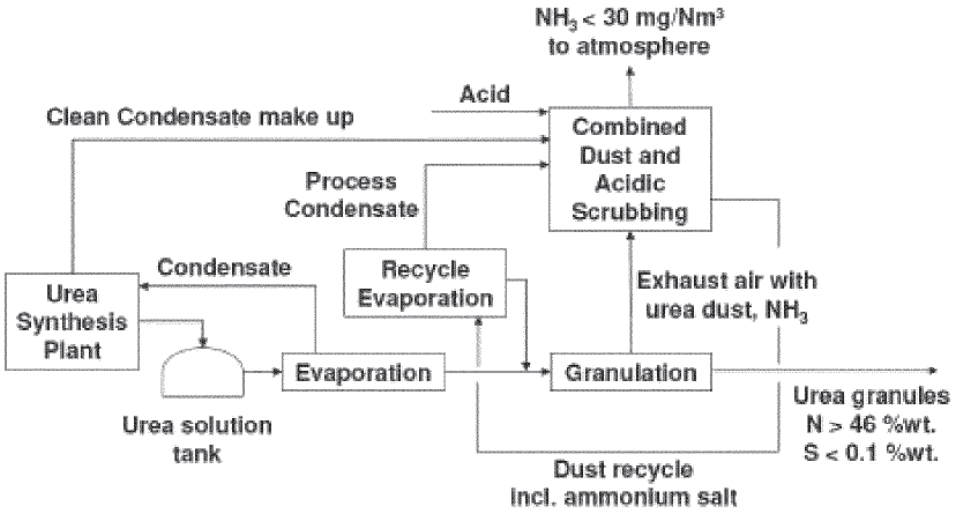
be directly fed back into the dust scrubber via line (10).

In this way, the stream passing through the first evaporation/condensation loop (E/F) may be reduced, leading to an overall reduction in energy consumption, particularly in the amount of hot steam (S2), as has been shown in example 1. Alternatively, the process yields more urea with the same energy consumption, as shown in example 2 of the patent.

7. Process and plant as described in D8a

D8a discusses problems associated with urea production plants ever increasing in size and capacity. In particular the size of the finishing units corresponding to unit (C) in the processes discussed in the patent, the so-called granulators or prilling towers in which the final solid form of the urea is obtained, is said to become unmanageable, see the introduction on the first page of D8a. D8a proposes to optimize granulator design as well as process parameters in order to limit the size increase of the granulator unit, see page 4. Furthermore, in order to reduce residual ammonia emissions from the granulator which are not caught by the usual wet scrubbing systems, D8a proposes the so-called "Ammonia Convert Technology" (ACT) in which exhaust ammonia exiting the dust scrubbing section is avoided by converting it into an ammonium salt by means of acid scrubbing, which is combined with the classical dust scrubbing corresponding to unit (D) above. The resulting ammonium salt does not need to be disposed of, but is admixed to the final urea product, see pages 6 and 7. In the context of the ACT a small evaporation/condensation

unit is added after the combined acid/dust scrubbing section, see figure "3" (should be figure 5) of D8a and the explanations on pages 6 and 7. This figure is as shown here:



In this figure, the "Evaporation" and "Granulation" units correspond to the evaporation unit (B) and the granulator (C) of the processes depicted above. The "Recycle Evaporation" corresponds to sections G and H of the process of the patent.

8. Choice of the closest prior art document

According to the well-established problem and solution approach for assessing inventive step under Article 56 EPC, first the document representing the closest prior art has to be defined, see Case Law Book I.D.2. The closest prior art document is, usually, a document disclosing subject-matter conceived for the same purpose or aiming at the same objective as the claimed invention, and having the most relevant technical features in common. A further criterion for the

selection of the most promising starting point is the similarity of the technical problem, see Case Law Book I.D.3.1.

8.1 D8a and D9 were discussed by the parties as possible starting points for the inventive step analysis. The appellant submitted that D9 represented the closest state of the art, the respondent argued that rather D8a should be the starting point. The Opposition Division followed the respondent and chose D8a.

8.2 As set out above, D9 discloses a "classical" urea production plant lacking the second evaporation/ condensation loop (G/H). D9 discloses the process which the disputed patent uses as a starting point for its considerations. Taking D9 as a starting point the claimed invention adds a second evaporation/ condensation loop (G/H) after the dust scrubbing unit (D) in order to achieve a reduction of the overall energy consumption, see paragraph [0020] of the patent.

8.3 On the other hand, D8a discusses problems associated with urea production plants ever increasing in size and capacity, as set out above. D8a focusses on the problematic size of the granulators and on the effluents, in particular ammonia, exiting the plants, see summary on the last page. Furthermore, the final product in D8a is not pure urea, as in the process of D9 and in the patent, but urea admixed with ammonium chloride.

8.4 In terms of technical features of the claim, the second evaporation/condensation loop (G/H) after the dust scrubbing unit (D) does not distinguish the claimed plant from D8a. Instead, the distinguishing features are (i) details of the dust scrubbing section, i. e.

that it is configured for using a circulating urea solution as a washing agent and a fresh water supply, (ii) the fluid communication of the second condenser (H) with the dust scrubbing section (D) and (iii) the absence of an acid scrubbing unit altogether. The second difference is based on the finding that D8a only discloses a "combined dust and acid scrubbing" unit, so that it is not clear whether the fluid exiting the second condenser in D8a communicates with a dust scrubbing unit (as required by the claim), or with an acid scrubbing unit, or with a combination of both.

8.5 D8a focusses on a technical problem which is different from that of the patent. Considering the problem as set out in the patent, i. e. the reduction of overall energy consumption of a classical urea production process, a skilled person would not have had much incentive to take D8a as a starting point in the first place. D8a tries itself to further develop the "classical process" with regard to controlling granulator size and exhaust ammonia. In order to take the further development D8a, rather than the classical process of D9, as a starting point, a skilled person would have to first realize that the direction taken in D8a may also be useful for the reduction of overall energy consumption. This is at least not explicitly stated in D8a.

8.6 In the view of the Board it is more realistic to assume a skilled person to start from a classic process such as the one of D9. D8a may act as a secondary document, i. e. a document a skilled person might have considered when trying to find a solution to the problem of reducing overall energy consumption of such a classical process.

8.7 The respondent did not deny that the primary purpose of D8a is different to the primary purpose of the invention as set out in the patent. Instead, the respondent argued with reference to decision T 1841/11 that a document structurally closer in terms of technical features of the claim, disclosing at least a similar purpose than aimed at in the patent, does not become unsuitable as a starting point for an inventive step analysis just because a document aiming at the same purpose is available, having however less structural features in common with the claim. Thus, independent of the existence of D9, D8a was a valid starting point for an inventive step analysis.

8.8 The concept of the "closest prior art" not only allows a structured and predictable assessment of inventive step, but also allows to reduce the number of individual inventive step analyses to be carried out to a minimum. It is correct to state that this concept cannot lead to the finding that a claimed invention is non-obvious over the "closest prior art", whereas it would have been obvious when starting from a different document. However, the fact that the process in D8a aims at a different goal, and achieves this goal with partly the same, but partly also different methods than in the patent, not only has consequences for the question of whether D8a is a suitable starting point for an inventive step analysis. This fact also has consequences for the question of whether an objection of lack of inventive step over this document can be successful at all, as set out in the following.

8.8.1 The respondent, as well as the Opposition Division, defined the objective problem to be solved starting from D8a as the provision of an alternative urea production plant. The reason for this rather

unambitious formulation of the objective technical problem was that the plant disclosed in D8a already contained the second evaporation/condensation loop G/H downstream of the dust scrubbing unit, i. e. the feature which the patent considers to be crucial for the reduction of energy consumption according to the claimed invention. Therefore, the claimed plant cannot achieve any reduction of energy consumption compared to D8a based on these features, see point 3.4.2 of the decision under appeal. This reduction was already inherently achieved in D8a.

8.8.2 Following these considerations the respondent then argued, in opposition as well as in appeal proceedings, that the distinguishing features re D8a, the details of the scrubbing section and in particular the omission of the acid scrubbing, were obvious variations for a skilled person when trying to find an alternative urea production plant. Urea production plants not having acid scrubbing units were known in the art. Moreover, the omission of the acid scrubbing would also remove the ammonium salt from the final urea product. The Opposition Division followed this argumentation, see point 3.4.3 of the decision under appeal.

8.8.3 However, this approach is fundamentally flawed. It is of course undeniable that urea production plants without an acid scrubbing units exist, using wet scrubbing only. Such a process is already described in the classical urea production plant in D9, as discussed above. The crucial point is, however, that the teaching of D8a is to improve such a classical process, and the proposed improvement in D8a is the "Ammonia convert technology", ACT, which uses acid scrubbing and admixes the ammonia salt thus obtained into the final urea product. Following the respondent's line of

argumentation, a skilled person would have started from the plant advertised in D8a as being improved over a classical urea production plant. Then, however, when looking for an alternative to the process disclosed therein, the skilled person would have gone back, thus giving up the very teaching of D8a, and would have considered that a plant without the ACT technology would likewise be feasible. Independent of the question of whether, in view of the further differences of the claimed plant with respect to D8a the resulting plant would be one according to claim 1 of the patent, a skilled person would just not act in such a way.

8.8.4 When starting from D8a a skilled person may have tried to further develop the concepts described therein, i. e. granulator design or the ACT technology, but it would not have given up its teaching. Starting from D8a, a skilled person would never have arrived at the production plant and the corresponding processes and methods defined in the claim of the patent.

8.9 Thus, these considerations confirm the appellant's point of view that D8a is not a suitable starting point for the assessment of inventive step of the plants and process defined in the claims of the patent.

9. Inventive step starting from D9

9.1 Inventive step starting from D9 is not dealt with in the decision under appeal.

9.2 As discussed extensively above, D9 discloses a "classical" urea production plant lacking the second evaporation/condensation loop (G/H).

9.3 Thus, the plant claimed in claim 1 and the methods/ process claimed in the other independent claims differ from the disclosure of D9 in the addition of the second evaporation/condensation loop (G/H). This was undisputed between the parties.

9.4 The technical effect achieved by the introduction of this second evaporation/condensation loop (G/H) is a reduction of the steam consumption (S2) for the same urea output, or an increase in urea production when keeping the steam consumption constant. The steam consumption (S2) essentially corresponds to the energy consumption of the process. These effects are shown in examples 1 and 2 of the patent. That the introduction of the second evaporation/condensation loop in fact leads to these effects was undisputed between the parties.

Thus, starting from D9 as closest prior art document the plant defined in claim 1 of the patent, which is characterized by the presence of a second evaporation section (G) and a second condensation unit (H) placed downstream of the dust scrubbing section, solves the objective technical problem of providing a urea production plant allowing to perform a more energy efficient process for the production of urea.

9.5 It remains to be decided whether the claimed solution to the objective technical problem was obvious for a skilled person, having regard to the state of the art.

9.5.1 It was not argued that the skilled person gets any hints from D9 itself how to reduce energy consumption in the process described therein.

9.5.2 The respondent argued that D8a disclosed the second evaporation/condensation loop corresponding to units (G) and (H) as reducing overall energy consumption of the process. It was referred to the second bullet point on page 7 of D8a. This bullet point reads as follows:

"*Separate small evaporation/vacuum condensation section for the dust and ammonia recovery from the scrubbing section. The process condensate from this recycle evaporation section can be used as make up liquid for the wet scrubbing system directly without further treatment in the desorber/hydrolysis section of the urea synthesis plant. This means*

reduced investment cost for desorber/hydrolysis section in urea synthesis

no migration of acidic scrubbing agent into urea synthesis plant

same steam and cooling water consumption as for urea plant without ACT."

In particular, the respondent referred to the mentioning of reduced investment costs for the desorber/hydrolysis section. In the respondent's view it would have been clear to a skilled person that the investment costs were lower because the equipment needed was smaller when the stream to be processed was smaller. A smaller desorber/hydrolysis section had of course less energy consumption than a bigger one.

9.5.3 However, this passage does not disclose that the second evaporation/condensation section leads to overall less energy consumption compared to a situation where such a section is missing.

The advantages of this section are disclosed in relation to a plant containing acid scrubbing. This is

apparent not only from the passage "*no migration of acidic scrubbing agent into urea synthesis plant*", but also from the context in which the second bullet point is disclosed; the whole list of bullet points relates to the ACT technology. It is unclear whether any advantages would be also achieved in a plant lacking the acid scrubbing section, just taking the second evaporation/condensation section in isolation. This holds in particular since the advantages are apparently linked to ("*this means*") the fact that the process condensate from the recycle section needs no further treatment before entering the scrubbing section. There is no disclosure in D8a from which a skilled person could deduce that this is likewise the case in the absence of acid scrubbing.

Additionally, the last point in the listing copied above reads "*same steam and cooling water consumption as for urea plant without ACT*". Thus, D8a does not disclose that the use of the technology presented therein leads to overall reduction of energy consumption.

9.5.4 D8a teaches a technology (i) to improve granulator design in view of the sizes needed for large plants and (ii) to deal with the gaseous effluents from plants of this size. The first issue is tackled by specific design methods (pages 4 and 5), the second by the ACT technology using acid scrubbing of the off-gases. D8a does not show that the addition of a second evaporation/condensation section corresponding to units (G) and (H) as defined in claim 1 leads to overall reduction of energy consumption in the process.

9.6 The urea production plant claimed in claim 1 of the patent as granted is based on an inventive step,

Article 56 EPC. The same holds for the processes and methods claimed in the other independent claims of the patent as granted.

10. Thus, none of the grounds for opposition under Article 100 EPC prejudices the maintenance of the patent. According to Article 101(2) EPC the opposition is to be rejected and the patent is to be maintained as granted.

11. Further requests by the parties

11.1 Since the patent as granted fulfils the requirements of the EPC the appellant's auxiliary requests do not need to be considered.

11.2 D12 was not discussed in any detail and its content is not relevant to the outcome of the proceedings. Thus, the respondent's request not to admit D12 into appeal proceedings does not need to be decided upon.

11.3 The respondent wished the Board to refer a question to the Enlarged Board of Appeal concerning the choice of the closest prior art document. However, this request was made after the chairman had already closed the oral proceedings. Thus, the request was made at a point in time where not only the debate on inventive step had been closed and, following deliberation of the Board, the decision had been announced, but even after closure of the oral proceedings altogether.

However, any submission in oral proceedings by the parties must be made before the debate is closed, see G 12/91, reasons 3 of the decision, unless the Board decides to reopen the debate to allow a further

substantive discussion of the issues concerned. After a final decision has been pronounced in oral proceedings the decision becomes effective by virtue of it being pronounced, enters into force and cannot be amended anymore, see G 12/91, reasons 2 of the decision. Reopening of the debate at this stage of the proceedings is no longer possible.

Thus, the Board cannot take this request into account.

Order

For these reasons it is decided that:

The decision under appeal is set aside.

The patent is maintained as granted.

The Registrar: The Chairman:

C. Rodríguez Rodríguez P. Gryczka

Decision electronically authenticated