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**Datasheet for the decision
of 28 April 2010**

Case Number: T 1052/07 - 3.3.06

Application Number: 01983519.8

Publication Number: 1333918

IPC: B01J 19/24

Language of the proceedings: EN

Title of invention:
Carbamate Condensation Unit

Patentee:
UREA CASALE S.A.

Opponent:
DSM IP Assets B.V.

Headword:
-

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 56

Keyword:
"Inventive step (main request and first auxiliary request): no
- obvious design option"
"Inventive step (second auxiliary request): yes - non obvious
modification"

Decisions cited:
T 0131/01

Catchword:
-



Case Number: T 1052/07 - 3.3.06

D E C I S I O N
of the Technical Board of Appeal 3.3.06
of 28 April 2010

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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
23 April 2007 concerning maintenance of
European patent No. 1333918 in amended form.

Composition of the Board:

Chairman: E. Bendl
Members: P. Ammendola
J. Geschwind

Summary of Facts and Submissions

I. The appeals are from the interlocutory decision of the Opposition Division concerning the maintenance in amended form of European patent No. 1 333 918 relating to a carbamate condensation unit (hereinafter condenser).

II. The granted version of this patent contained six claims. Claims 1 and 6 **as granted** were independent and read, respectively:

"1. Carbamate condensation unit (1) of the submerged type for synthesis urea production plants, comprising:

- a substantially cylindrical shell (2), closed at the opposed ends thereof by an upper (3) and a lower (4) bottom, respectively, defining an intermediate portion (9), an upper portion (10) and a lower portion (11) of the condensation unit;*
- a tube bundle (5) for the condensation of gaseous compounds, fitted into said intermediate portion (9) of the condensation unit, in fluid communication with said upper portion (10) and said lower portion (11) and comprising an upper (7) and a lower (8) tube plate, respectively, and a plurality of tubes (6) supported by them;*
- a duct (16) extended in said lower portion (11) below said tube bundle (5) for feeding said gaseous compounds to be condensed;*

- discharge openings (12, 13) provided in said upper portion (10) for discharging outside the condensation unit uncondensed gaseous compounds and condensed gaseous compounds, respectively,

characterized in that it comprises:

- a duct (19), structurally independent from said tube bundle (5) and said discharge openings (12, 13), in fluid communication with said upper and lower portions (10, 11) for the circulation of part of said condensed gaseous compounds."

"6. Method of retrofitting a pre-existing carbamate condensation unit (1) for synthesis urea production plants, comprising:

- a substantially cylindrical shell (2), closed at the opposed ends thereof by an upper (3) and a lower (4) bottom, respectively, defining an intermediate portion (9), an upper portion (10) and a lower portion (11) of the condensation unit;
- a tube bundle (5) for the condensation of gaseous compounds, fitted into said intermediate portion (9) of the condensation unit, in fluid communication with said upper portion (10) and said lower portion (11) and comprising an upper (7) and a lower (8) tube plate, respectively, and a plurality of tubes (6) supported by them,

said method being **characterized in that** it comprises the steps of:

- *providing a duct (19) structurally independent from said tube bundle (5) and external to said shell (2), in fluid communication with said upper and lower portions (10, 11) for the circulation of part of said condensed gaseous compounds;*

and

- *providing a tank (27) associated to said upper bottom (3), in fluid communication with said upper portion (10) and said duct (19) external to said shell (2) and comprising discharge openings (28, 29) for discharging outside the condensation unit uncondensed gaseous compounds and condensed gaseous compounds, respectively;*
- *providing a duct (16) extended in said lower portion (11) below said tube bundle (5) for feeding said gaseous compounds to be condensed."*

Claims 2 to 5 as granted described preferred embodiments of the condenser of claim 1.

III. Notice of opposition was filed by using the standard form EPO 2300-04.93 in which it was indicated in the box referring to Article 100(a) EPC that the subject-matter of the European patent was held not patentable. The two boxes, respectively indicating that it lacked novelty (Articles 52(1), 54 EPC) and inventive step (Articles 52(1), 56 EPC) had been crossed. The statement of grounds of opposition annexed to this form comprised a section headed "Novelty" which referred to granted claims 1, 4 and 5, and a section headed "Inventive Step" which referred to granted claims 2, 3

and 6. In this statement the Opponent made reference, *inter alia*, to the documents

(1) = WO 00/43358

and

(3) = EP 1 036 787 A1.

During the opposition proceedings the Opponent argued that claim 1 as granted also lacked inventive step in view of the prior art cited in the statement of grounds of opposition. The Patent Proprietor filed, *inter alia*, an amended set of claims labelled as the second auxiliary request and a description adapted thereto.

IV. Claim 1 of that amended set of claims (hereinafter claim 1 **as maintained**) differed from claim 1 as granted (see section II above) only in that the wording "- a duct (19), *structurally independent*" was replaced by "- a duct (19), *external to said shell (2), structurally independent*".

V. The Opposition Division found in the decision under appeal that the ground of opposition of lack of inventive step had also been properly substantiated as stipulated by Rule 55(c) EPC 1973 and was therefore admissible. In particular, since granted claim 1 had been attacked for novelty in the statement setting out the grounds of opposition, and since novelty was a prerequisite for determining the presence or absence of an inventive step, the Opposition Division concluded that the attack against the novelty of claim 1 included an implicit attack on inventive step. In its reasoning

in this respect the Opposition Division considered the present situation comparable to that of T 131/01.

As to the issue of inventive step, the Opposition Division concurred with the parties that document (3) represented the closest prior art, from which the subject-matter of claim 1 as granted only differed for the presence of a duct that was **structurally independent** from the tube bundle and used for the **circulation** of the **carbamate** (hereinafter indicated as SICC duct).

The Department of first instance considered, *inter alia*, that the technical problem identified in the patent-in-suit was not solved for the whole range of embodiments covered by the subject-matter of granted claim 1. The Opposition Division considered part of the subject-matter of granted claim 1 as a technically non-functional modification of the known device of document (3) and, thus, as a modification of the prior art which lacked inventive step. Moreover, the fact that a coaxial SICC duct could promote the circulation of the carbamate solution and, thus, also favour the heat exchange in the condenser was considered predictable in view of the teaching of document (1).

The subject-matter of the claims as maintained (i.e. those according to the then pending second auxiliary request) required instead the presence of a SICC duct that was external to the bundle of tubes. This limitation would effectively increase the surface available for heat exchange and, thus, would solve the posed technical problem. The Opposition Division was satisfied that the presence of an external duct would

lead to a preferential circulation through said duct because, on the one hand, the external duct would have a lower headloss compared with the smaller heat exchanger tubes, and, on the other hand, the schematic drawings in the patent-in-suit did not exclude the use of further means to increase the circulation through the duct. As these means would be well known to the skilled person, they did not necessarily need to be specified in the patent. Moreover, document (1) only disclosed a downcomer, i.e. a coaxially arranged SICC duct. Hence, the available prior art would not even mention an external SICC duct.

The Opposition Division concluded, therefore, that the patent amended according to the then pending second auxiliary request complied with the requirements of the EPC.

VI. Both Opponent and the Patent Proprietor appealed against this decision. Hereinafter the Opponent and Appellant I is indicated as the **Opponent**, and the Patent Proprietor and Appellant II is indicated as the **Proprietor**.

In the statement of the grounds of appeal the Proprietor reported the results of computer simulations quantifying the volume reduction obtained when replacing a plurality of smaller tubes by a single larger duct.

Oral proceedings took place before the Board on 28 April 2010 in the presence of both parties.

During the hearing the Proprietor filed an amended set of six claims labelled as the second auxiliary request.

- VII. Claims 1 and 6 of such **second auxiliary request** differed respectively from claim 1 and 6 as granted (see section II above) only in that the wording "*for the circulation of part of said gaseous compounds*" was replaced by "*for the circulation of part of said gaseous compounds, wherein the tube bundle is exclusively used to carry out the condensation*".

Claims 2 to 5 of this request were as granted.

- VIII. The Opponent, after having stated that it did not need time to study this request, argued that it violated Articles 83, 84 and 56 EPC. The Proprietor expressly objected to the introduction at this stage of the proceedings of an objection as to sufficiency of disclosure and the Board, after deliberation, informed the Parties that the issue of sufficiency of disclosure was not to be discussed during the oral proceedings.

The Opponent then disputed the admissibility of the Proprietor's second auxiliary request as late filed and requested, in the event that the Board admitted it into the appeal proceedings, remittal to the Department of first instance or at least an adjournment of the oral proceedings before the Board.

Invited by the Board to present also its substantive objections to the patentability of the second auxiliary request, the Opponent withdrew its previous objection under Article 84 EPC and disputed said request exclusively on the basis of absence of inventive step.

IX. The Opponent relied on substantially the same reasons as were indicated by the Opposition Division in the decision under appeal for maintaining that the lack of inventive step of **granted claim 1** had already been implicitly objected to in the statement of grounds of opposition.

Moreover, it considered that the subject-matter of this claim and that of **claim 1 as maintained** lacked inventive step vis-à-vis the prior art condenser of figure 6 of document (3), for reasons which may be summarized as follows:

- Neither claim 1 as granted nor that as maintained indicated the dimensions of the SICC duct or of the gas distribution chamber and, thus, they allowed e.g. for gas distribution chambers that covered only a part of the cross section of the condenser and for ducts insufficient for the required circulation of carbamate solution.
- Accordingly, these claims encompassed condensers such as those obtainable by retrofitting e.g. the condenser of figure 6 of document (3) according to the method of the invention as defined in claim 6 as granted, i.e. by simply adding thereto an external SICC duct, while leaving unchanged the internal structure of the condenser of the prior art. In these condensers of the invention nothing would force the reagent mixture also to flow upwards through the peripheral tubes of the bundle that were located close to the wall of the condensation unit and, thus, outside the cross

section of the gas distribution chamber, thereby leaving unchanged - or even reduced in the case of a coaxial SICC duct - the number of tubes of the bundle in which the condensation really occurred.

- Hence, these claims appeared to miss some essential features and, thus, to encompass subject-matter that could not solve the technical problem addressed in the patent-in-suit.

The results of the computer simulations reported in the Proprietor's grounds of appeal were not reliable and, in any case, did not prove anything more than the self-evident fact that the use of a single larger circulation duct instead of a plurality of smaller circulation tubes made it possible to avoid space being lost in between the smaller tubes.

Therefore, and since to add e.g. an external duct to a chemical reactor as an alternative line for the circulation of matter in one of the directions needed, represented an obvious option for the person skilled in the art of designing chemical reaction plants, the subject-matter of these claims represented just an obvious alternative to the condensers of document (3).

The Opponent disputed as belated the filing of the **second auxiliary request** by the Proprietor and justified its request to remit the case to the Opposition Division or to adjourn the oral proceedings before the Board by the need to carry out a further search on the prior art.

This Party raised the Article 83 EPC objection against the second auxiliary request, that the skilled reader of the patent-in-suit would not know what technical measures should be taken in order to ensure that the tubes of the bundle were exclusively used to carry out the carbamate condensation. It justified the filing of this objection as a reaction to the filing of the Proprietor's second auxiliary request, in which such exclusive use had been introduced for the first time in the claims. Moreover, this objection did not constitute a fresh ground of opposition because it was directed against a set of amended claims.

In respect of the inventive step assessment for the second auxiliary request, the Opponent argued that the person skilled in the art searching for a solution to the technical problem underlying the invention would find in document (3) the indication that only a fraction of the tubes in the bundle were used for condensation. He/she would then learn from document (1) that it was instead possible to use all the tubes for condensation, if the circulation of the carbamate solution was carried through a downcomer, i.e. a coaxially arranged SICC duct. Moreover, such measure was also explicitly indicated in document (1) as favouring heat exchange. The fact that this citation related mainly to a "combi-reactor" would not influence the skilled person's choice: knowing that the reactor section was not present in the condenser of document (3), the skilled person would just disregard the upper section of the downcomer exemplified in document (1). Therefore, the combination of these citations would render it obvious to increase the prior art condenser's heat exchange.

A similar reasoning applied also to the external version of the condenser encompassed by the same claim, as well as to the method for retrofitting pre-existing condensers defined in claim 6 as granted.

Hence, the subject-matter of claims 1 and 6 of the second auxiliary request lacked an inventive step in view of the combination of documents (3) and (1) and of the common general knowledge of the person skilled in the art.

- X. The Proprietor considered erroneous the finding of the Opposition Division that an objection of lack of inventive step against claim 1 as granted was implied in the statement of grounds of opposition. It submitted that the cited decision T 131/01 was not comparable to the present situation, since in the case dealt with in T 131/01, an inventive step attack was submitted as a precaution in the notice of opposition itself.

Furthermore, the Proprietor considered the condenser of e.g. figure 6 of document (3) a suitable starting point for the assessment of inventive step.

It refuted the reasoning of the Opponent that the subject-matter claimed in **claim 1 as granted or as maintained** encompassed condensers in which the advantageous technical effect of the invention would not be produced, for substantially the following reasons:

- This effect, which was expressly indicated in paragraphs [0015] and [0016] of the patent-in-suit,

of rendering it possible to use all the tubes of the bundle for the condensation, was the necessary consequence of the features indicated in these claims and, in particular, of the presence of a SICC duct whose precise design and dimensioning were carried out by a person skilled in the art. As the condensation yield was strictly bound to the portion of the tube bundle intended for the condensation (i.e. to the heat exchange surface), the desired increase in yield vis-à-vis the prior art indicated in paragraphs [0008] to [0011] was therefore also achieved, due to the exclusive use of the tubes for the condensation made possible by the presence of the SICC duct.

- As reliably demonstrated by the results of computer simulations submitted with the grounds of appeal, even when the SICC duct was coaxial to the shell the number of tubes available for condensation was superior to that of the tubes dedicated to this reaction in the prior art. Indeed, not only a single duct of a given section inevitably occupied less volume than a plurality of smaller tubes whose overall internal sections added up to at least that of the duct, but a large duct would also have a lower headloss compared with smaller heat exchanger tubes. Hence, the SICC duct necessary to allow the circulation of a given amount of carbamate solution would occupy a smaller volume than that required by the plurality of tubes dedicated in the prior art to the circulation of that very same amount of carbamate solution.

Hence, all the condensers claimed in claim 1 as granted or maintained would solve the technical problem mentioned in the patent-in-suit.

As to the Opponent's objection to the lateness of the filing of the **second auxiliary request** at the hearing before the Board, the Proprietor argued that it was justified by the immediately preceding discussion on the granted and maintained claims. It stressed that the sole amendment introduced in this request consisted in making explicit the effect on which the invention was based and that the Proprietor had previously constantly indicated as being already implied by the essential features of the invention already given in the granted or maintained claims.

In the Proprietor's opinion the nature of this amendment did not, however, justify the filing at this stage of the proceedings of the Opponent's novel objection to the sufficiency of disclosure. Such objection constituted an inadmissible fresh ground of opposition.

As to the inventive step assessment of the second auxiliary request, the Proprietor stressed that document (3) indicated as advantageous the use of some of the tubes of the bundle for the circulation of the carbamate solution.

Moreover, the technical problem of increasing the condenser yield was neither disclosed nor suggested in document (1). Indeed, this citation addressed the different technical problem of providing the whole process for the preparation of urea with lower

investment costs, and used to this end a combi-reactor that had to comply with operating conditions different from those required in a condenser.

Finally, the fact that in the combi-reactor of figure 5 of document (1), the condenser section was crossed by a downcomer for the circulation of the carbamate solution would not exclude that some of the tubes of the bundle were also available for such circulation. Rather to the contrary, a possible contribution of the tubes of the bundle to the circulation of the carbamate solution appeared perfectly consistent with the disclosure at page 18, lines 18 to 22, of document (1) that "*further*" circulation via the downcomer was ensured by the funnel optionally present above this latter.

Therefore, the skilled person aiming at increasing the yield of the condenser of figure 6 of document (3), would not have considered it self-evident to go against the mandatory teaching of this citation that part of the tubes of the bundle were to be used for the carbamate circulation.

Nor did the combi-reactor disclosed in document (1) represent relevant prior art. But even if a skilled person had taken this citation into consideration, he/she would have derived therefrom at most the possibility of adding a downcomer, but not the use of all the tubes of the bundle exclusively for condensation.

XI. The Opponent requested that the decision under appeal be set aside and the patent be revoked.

The Proprietor requested that the decision under appeal be set aside and that the patent be maintained as granted. Alternatively, the Proprietor requested that the appeal of the Opponent be dismissed or in the alternative that the patent be maintained on the basis of the second auxiliary request filed during oral proceedings.

Reasons for the Decision

Procedural issues

1. Admissibility of inventive step as a ground of opposition against claim 1 as granted.
 - 1.1 The Proprietor has disputed the finding of the Opposition Division that lack of inventive step had also been raised as a ground of opposition against claim 1. The only argument in this respect presented by the Proprietor in the appeal proceedings is that the present situation is different from that considered in T 131/01, to which the Department of first instance referred in the decision under appeal. Indeed, in the present case no mention of lack of inventive step was contained in the notice of opposition.
 - 1.2 The Board considers the Proprietor's argument insufficient already because there are other aspects in the notice of opposition and in the statement of grounds of opposition of the present case, that appear unambiguously indicative of an implicit objection of lack of inventive step against claim 1 as granted. Indeed, in the present case (see section III of the

Facts and Submissions above), the box in the standard EPO form indicating that the patent-in-suit lacks of an inventive step is crossed, and the objection under Article 56 EPC explicitly raised and substantiated in the statement of grounds in respect of claims 2 and 3 dependent on claim 1, necessarily imply the same objection of lack of inventive step at least against those portions of the subject-matter of claim 1 corresponding to claims 2 and 3. Hence, the Board sees no reason to depart from the finding of the Opposition Division on this point.

2. Admissibility of the Proprietor's second auxiliary request and related requests of the Opponent to remit the case to the First Instance or to postpone the oral proceedings before the Board.

2.1 The Proprietor has justified the filing of the set of claims of the second auxiliary request only at the stage of the oral proceedings before the Board as follows:

The sole amendment introduced in the claims of this request is that of rendering explicit the **advantageous technical effect** produced by the invention, i.e. that the tubes of the condenser are used exclusively for the carbamate condensation, rather than also for the circulation to the lower section of the condenser of the carbamate solution resulting from such condensation. This effect is repeatedly and unambiguously identified in the patent as granted, in particular, in paragraphs [0015] and [0016] (reading "*Thanks to the present invention, the whole tube bundle is used in order to carry out the condensation step. ...*

As the tube bundle is exclusively used to carry out the condensation, the present invention allows advantageously increasing the yield of such condensation, the size of the tube bundle being the same."). The Proprietor, although remaining of the opinion that such effect was a necessary consequence of the essential features explicitly described in the claims as granted or as maintained, argued that the discussion at the hearing as to the credibility of such technical effect over the whole range claimed in these claims prompted the Proprietor to introduce an explicit recitation of such effect into the claims.

- 2.2 The Board finds that this amendment of the Proprietor's case is late filed because the Opponent had already indicated in its grounds of appeal that the subject-matter claimed in the maintained version of claim 1 was not limited to condensers producing the above-identified technical effect. Hence, at least upon reading the Opponent's statement of grounds of appeal the Proprietor was already aware that the Board had to decide on whether or not the exclusive use of the tubes for condensation was the inevitable consequence of the features expressly mentioned in the version of the claims as granted or maintained. Accordingly, already at the beginning of the appeal proceedings the Appellant could and should have considered which, if any, alternative version(s) of the claims to file an auxiliary basis as a fall-back position in case the Board should concur with the Opponent's interpretation of the claims maintained (and/or granted).
- 2.3 However, the same reasons render also self-evident that the Opponent too knew, well before the oral proceedings,

that the Board was going to decide on the disputed interpretation of the claims as granted and maintained. Thus, the Opponent was inevitably already aware, when preparing for the oral proceedings before the Board, that the inventiveness of the condensers of the invention in which all the tubes were used for the condensation, was already going to be discussed at the hearing.

2.4 Accordingly, the Board concludes that the amendment of the Proprietor's case at the oral proceedings, although belated, did not take the other Party by surprise and, thus, that this latter was in a position to reply without adjournment of the oral proceedings. For this reason the Board, exercising its discretion under the provisions of Article 13(1) RPBA, decided to admit the Proprietor's second auxiliary request into the appeal proceedings.

2.5 For the same reasons as indicated above, the Board finds that the requests of the Opponent to remit the case to the Opposition Division for consideration of the patentability of the claims of the second auxiliary request or to adjourn the oral proceedings before the Board were not justified.

3. Admissibility of the Opponent's Article 83 EPC objection to the second auxiliary request.

3.1 At the oral proceedings the Opponent, confronted with the filing of the second auxiliary request, changed its case by raising an objection under Article 83 EPC for the first time. In particular, in the opinion of this Party, the skilled reader of the patent-in-suit would

not know what technical measures should be taken in order to ensure that the tubes were exclusively used to carry out the carbamate condensation. It justified not raising such objection until the hearing before the Board because such effect was mentioned only in the claims of the second auxiliary request. Moreover, such objection did not constitute a fresh ground of opposition because it was directed against a set of amended claims.

- 3.2 The Board considers it immediately evident that such objection under Article 83 EPC took the Proprietor by surprise.

Indeed, as already indicated repeatedly above, the Proprietor's whole line of argument during the opposition and appeal proceedings is based on the consideration that the subject-matter of the version of claims as granted or maintained **necessarily** produced the above-identified advantageous technical effect. In support of this consideration the Proprietor affirmed already before the Opposition Division and repeated in the appeal proceedings (see e.g. its letter of 18 March 2010, page 4, lines 11 to 14,) that on the basis of the information derivable from the patent-in-suit it was **well within the skilled person's general knowledge** e.g. to give suitable dimensions to the gas distribution chamber and the SICC duct and to operate the carbamate condensation unit so as to achieve the desired exclusive use of the tubes for the condensation.

Similarly, in the decision under appeal (see page 9, lines 8 to 11) the Opposition Division found, *inter alia*, that in the patent-in-suit "... *the schematic*

*drawings do not exclude the use of further means to increase the circulation through the duct (arrangement of gas distribution chamber, pumps). Since **such measures are well known to the skilled person** they need not necessarily be specified in the patent specification"* (emphasis added by the Board).

Accordingly, the rejection of the granted claims by the Opposition Division is not based either on the finding that a skilled person aware of common general knowledge would not know how to realize the exclusive use of the tubes for the condensation (see page 5, lines 9 to 27, of the reasons of the decision under appeal). The fact that these arguments of the Proprietor or reasons of the Opposition Division were given in relation to the issue of inventive step does not change their relevance.

Equally relevant is that in its written submissions during the appeal proceedings the Opponent neither disputed any of these arguments or reasons, nor presented other objections clearly implying that the common general knowledge in the relevant technical field would not enable the skilled reader of the patent-in-suit to arrive at condensers producing the technical effect that constitutes the essence of the invention.

On the contrary, the Opponent's arguments (presented previously to and at the oral proceedings of 28 April 2010) were not only focused on the absence **in the claims of patent-in-suit** (as granted or as maintained) of those further technical features that - in addition to the construction of the SICC duct - were considered essential for producing the alleged technical effect of

the invention, but these arguments implicitly confirmed the existence **in the common general knowledge of the skilled person** of sufficient information as to what such essential features could be. Indeed, the Opponent itself has identified at least one measure that in combination with an appropriately sized and arranged SICC duct would ensure the exclusive use of all the condenser's tubes for the carbamate condensation (see the possibility mentioned, *inter alia*, in the first sentence at page 3 of the Opponent's grounds of appeal, of using a gas distribution chamber covering the whole cross section of the condensation unit).

Therefore, it is only with the objection raised under Article 83 EPC at the hearing that the Opponent has for the first time disputed the extent of common general knowledge of the skilled person with regard to the technical measures that can be used for controlling the direction of flow in the tubes of the condenser.

- 3.3 In the absence of any previous indication in this respect, the Proprietor thus had no reason, when preparing for the oral proceedings before the Board, to look for evidence in support of its own undisputed previous statements as to the extent of such common general knowledge.

Nor is the nature of the amendment in the second auxiliary request a justification for this unexpected objection by the Opponent, since, as discussed above, this amendment merely limits explicitly the claimed subject-matter to the condenser and the retrofitting method that the Proprietor has indicated throughout the opposition and appeal proceedings as the sole intended

subject-matter of the granted and maintained claims and that the Opposition Division has implicitly acknowledged as the sole subject-matter actually claimed therein.

Therefore, the Board considers it immediately apparent that the Opponent's objection under Article 83 EPC constitutes an amendment of this Party's case which has taken the Proprietor by surprise and to which this latter could not reasonably be expected to reply without adjournment of the oral proceedings. Hence, this objection is not admitted in view of the provisions of Article 13(3) RPBA.

Accordingly, it has turned out unnecessary for the Board to investigate further whether such objection would or not also represent an inadmissible fresh ground of opposition.

Patent as granted (Proprietor's main request)

4. Inventive step (Article 56 EPC): claim 1
- 4.1 Granted claim 1 defines a carbamate condenser of the submerged type, comprising a substantially cylindrical shell whose intermediate portion is constituted by a tube bundle. Such condenser is characterized by the presence of a SICC duct (see section II of the Facts and Submissions above). It is apparent and undisputed that such duct can be either external or arranged coaxially to the shell.

As indicated above, the advantageous technical effect identified in the patent-in-suit as produced by the

invention consists in the use of all the tubes of the tube bundle exclusively for the condensation of ammonia with carbon dioxide to carbamate while the stream of these two reagents flows upwards inside the tubes, i.e. necessarily excluding their use for also circulating the carbamate solution produced by such reaction downwards to the lower section of the condenser. This effect would necessarily result in a gain in terms of heat exchange surface for a given volume of the condenser and, thus, ensure the achievement of an increased yield (see paragraphs [0008] to [0011], [0015] and [0016] of the granted patent).

4.2 Since document (3) discloses the same sort of condensers as the patent-in-suit and addresses the problem of "*an increase of the production capacity*" of such condensers (see paragraph [0014] of document (3)), the Board concurs with the parties that this prior art, and in particular the condenser of figure 6 therein, represents a reasonable starting point for the assessment of inventive step. It is undisputed that document (3) indicates explicitly that the tubes of the condenser disclosed e.g. in figure 6 are not used exclusively for the flow upwards of the reacting mixture, but for the circulation downwards of the resulting carbamate solution as well (see in document (3) paragraphs [0028] and [0139]).

4.3 It is also undisputed between the parties that the condenser of granted claim 1 differs explicitly from this prior art only in the additional presence of the SICC duct. The parties have however disputed whether this explicitly defined distinguishing feature also implies the inevitable achievement of the advantageous

technical effect of the invention identified above over the whole claimed range, and, thus, of the solution of the technical problem of an increase in yield vis-à-vis the prior art.

- 4.3.1 The Proprietor has argued in this respect that any technically reasonable realization of the features of claim 1 as granted implies sizing and arranging e.g. the SICC duct so that the entire circulation downwards only occurs through this duct and, thus, also inevitably implies that all of the condenser's tubes are exclusively used for the carbamate condensation. Such exclusive use would then, for any given size of the condenser's shell, necessarily correspond to an increase in the heat surface available for the condensation and, thus, in yield.

The Board takes the view that such gain is substantial not only in the manifest case of the embodiments of the invention wherein the SICC duct is external, but also when such duct is arranged coaxially to the condenser shell. As also shown by the results of computer simulations reported in the grounds of appeal, in the latter case too the volume in the condenser's intermediate section occupied by the coaxial SICC duct is significantly smaller than that occupied by the plurality of tubes required for the same circulation downwards in the condensers of the prior art.

- 4.3.2 The Opponent has refuted the relevance of such results because computer simulations are, in its submissions, no reliable source of information. Hence, in the opinion of this Party, neither the patent-in-suit nor these results make it plausible that simply

retrofitting the condensers of the prior art with a SICC duct would necessarily turn the tubes in these condensers previously used for the flow downwards of the carbamate solution, into tubes for the flow upwards of the reagent mixture for the carbamate condensation. Hence, the claimed subject-matter would embrace condensers in which the heat exchange surface would remain unchanged. Accordingly, the technical problem solved over the whole of the claimed range would merely be the provision of an alternative to the prior art.

- 4.3.3 The Board considers preliminarily self-evident that when the whole circulation downwards of the carbamate solution in the claimed condensers only occurs through a SICC duct that is present externally to the shell containing the tube bundle and as long as all the tubes of the bundle are actually used for the condensation only, this renders necessarily available a larger heat exchange surface in comparison to the condensers of document (3) which having an identically sized shell and, thus, contain the same number of tubes in the bundle. Hence, the Board concurs with the Proprietor and with the Opposition Division that it is perfectly reasonable to expect that these embodiments of the claimed subject-matter certainly result in superior condensation yield vis-à-vis the prior art, thereby solving the technical problem mentioned in the patent-in-suit. This has not been disputed by the Opponent. The Board also finds in favour of the Proprietor but contrary to the finding of the Opposition Division that the desired increase in heat exchange surface and, thus, in yield, is also plausible in those other embodiments of the claimed subject-matter in which the SICC duct is arranged coaxially to the shell, as long

as all the tubes of the bundle are actually used for the condensation only.

Independently of the fact that the same has been confirmed by the results of computer simulations reported by the Proprietor in its grounds of appeal, a first element supporting this finding is that, as also acknowledged by the Opponent, a single duct of a given section inevitably occupies less volume than a plurality of smaller tubes whose overall internal sections add up to (at least) that of the duct, since the volume actually occupied by the plurality of tubes inevitably includes unused space in between the tubes. A further saving in the condenser's volume dedicated to the circulation appears self-evident to the Board in view of the minor amount of material required for forming the walls of a single SICC duct in comparison to that required for delimiting the plurality of smaller tubes. Finally, it is also perfectly plausible, and also acknowledged by the Opposition Division and undisputed by the Opponent, that *"a larger duct would have a lower headloss compared with smaller heat exchanger tubes"* (see the decision under appeal, page 9, lines 6 to 8). Hence, the SICC coaxial duct necessary for circulating a given amount of carbamate solution is reasonably expected to occupy a volume that is substantially smaller than that (inclusive of the unused space unavoidably trapped in between the tubes) occupied by the plurality of tubes necessary in the prior art for the circulation of that very same amount of carbamate solution.

Thus, the Board has no reason to doubt that **as long as all the tubes of the bundle of the claimed condensers**

are actually used for the condensation only, all claimed condensers offer a larger heat exchange surface for the reaction and, thus, produce an increase in yield, in comparison to similar condensers of the prior art using part of the tubes of the bundle for circulation.

This conclusion of the Board is not based on the results of the computer simulations which were provided by the Proprietor without details of how these simulations were made. Nevertheless, in the absence of any evidence to the contrary, the Board finds unjustified the criticism of the Opponent to their meaningfulness. Indeed, computer simulations are a standard tool for the evaluation and design of industrial chemical reactors. Moreover, it is apparent that these data only aim at quantifying the saving in volume obtainable when a single larger duct is used instead of a plurality of smaller tubes for fluid circulation, i.e. a saving in volume that the Opponent itself has expressly acknowledged as self-evident.

4.3.4 The Board also notes however that, contrary to the Proprietor's line of argument, the features of claim 1 as granted neither expressly require nor necessarily imply that all the tubes of the bundle are exclusively used for condensation.

The Proprietor has maintained, in this respect, that for the person skilled in the art this claim can only reasonably be interpreted as defining condensers in which the size and the arrangement of the SICC duct are suitable for producing sufficient circulation and, thus, for also making available for condensation the

tubes that in the prior art are instead needed for circulation.

The Board notes however that the relevant question is not whether the SICC duct is implicitly required to be sized and arranged so as to allow sufficient circulation, but whether the presence of such SICC duct inevitably means that all the tubes of the bundle are not just possibly available for the condensation, but rather **actually used** for the condensation only. Indeed, only in this latter case will the heat exchange surface actually be increased and the problem posed credibly solved.

The Board notes that the Proprietor has provided no experimental evidence or convincing detailed reasoning demonstrating that the presence of a SICC duct (realized in a technically sound manner) as required in granted claim 1 inevitably results in the exclusive use of the tubes for the condensation.

Nor is it correct to assume that the skilled person would read the wording of claim 1 as granted as implying the instruction to reach the advantageous technical effect of the invention and, thus, as implicitly excluding from the possible embodiments of the claimed subject-matter those which would not achieve such technical effect.

Indeed, such a restrictive interpretation of the claim cannot be justified simply because the effect of the invention is indicated in the description.

Nor is such a restrictive interpretation the sole possible technically sound interpretation of the wording of the claim in the context of the whole disclosure of the patent-in-suit. In this respect the Board notes preliminarily that to realize carbamate condensers in which the required circulation downwards may occur along more than one path does not appear *per se* a technical nonsense that would be immediately disregarded by the skilled person for self-evident reasons. Moreover, an interpretation of claim 1 as granted also encompassing the possibility that the peripheral tubes of the bundle are still used for circulation, appears rather consistent with the method for retrofitting pre-existing condensers which is also disclosed the patent-in-suit. Indeed, the retrofitting method defined e.g. in claim 6 as granted requires also only the application to the condensers of the prior art (such as e.g. those of document (3)) of an external SICC duct, an upper tank and a gas feeding duct extending into the lower bottom of the condenser. However, the design of the starting condenser of document (3) to be retrofitted is undisputedly conceived for promoting downward circulation of the carbamate solution through the tubes present in the peripheral region of the bundle. In particular, figure 6 of document (3) suggests that this is achieved by the gas distribution chamber lying below the tube bundle being dimensioned such as **not** to distribute the upward streaming gas bubbles in the peripheral tubes intended for circulation. Since no specific dimensioning of the gas distribution chamber is required by the definition of the retrofitting method given in granted claim 6 and not in the corresponding specifications of the patent-in-suit, this latter appears to encompass also

condensers that are obtainable by just adding a SICC duct and a tank to the pre-existing condensers of document (3), without changing the gas distribution chamber therein. Accordingly, in the condensers of the invention too the gas distribution chambers appear possibly not covering the whole cross section of the bundle and, thus, not necessarily producing the flow of gaseous reagents upwards though the peripheral tubes of the bundle as well. Therefore, it is also perfectly consistent with the whole disclosure of the patent-in-suit to interpret granted claim 1 as not implying the exclusion of condensers in which some of the tubes of the bundle are possibly used for carbamate circulation.

- 4.3.5 It is apparent that in those embodiments of the patented condenser in which the circulation downwards of the carbamate solution may still also occur though e.g. the peripheral tubes of the bundle, the number of tubes actually used for condensation may remain the same (or even be reduced in the case of the coaxial SICC duct) as in the condensers of the prior art and, thus, that the achievement of the desired increases in heat exchange surface and yield is not credible.

For this reason alone, the Board concludes that the technical problem stated in the patent-in-suit is not credibly solved over the whole scope of claim 1 as granted.

- 4.3.6 Hence, the sole technical problem credibly solved by the whole subject-matter of claim 1 as granted consists in the provision of further carbamate condensers, i.e. of an alternative to the prior art.

- 4.4 This problem has been solved by using a duct for the downward circulation of the carbamate solution. In particular, such duct can be either external or arranged coaxially to the condenser shell.
- 4.4.1 The Opponent has stressed that to add a duct, and in particular an external duct, to a chemical reactor as an alternative line for circulation of matter in one of the required directions, represents an obvious option for the person skilled in the art of designing chemical reaction plants.
- 4.4.2 This has not been disputed by the Proprietor, who has indeed acknowledged that document (3) itself indicates in paragraphs [0028] and [0139] the use of the peripheral region of the tube bundle for circulation of the carbamate solution, as evident from figure 6 of this citation. The Proprietor has concluded therefrom that document (3) motivates the skilled person to obtain the circulation of the carbamate solution exclusively through the peripheral tubes of the bundle. However, the instruction to use the peripheral tubes of the bundle for circulation is described in paragraph [0139] of document (3) as a measure for obtaining "*maximum exploitation of the inner volume of the condenser*". This vague teaching, in as far it might be understood by the Board, could at most imply leaving the arrangement of the interior of the condenser of document (3) unchanged, but it has no implication as to the external modifications that the skilled person could or not take into consideration.

In conclusion, the undisputedly conventional design option of adding an external duct to a chemical reactor

cannot possibly affect the "*exploitation of the inner volume*" of that reactor. Hence, the person skilled in art only has to make an arbitrary choice, devoid of inventive merits, from among the equally obvious design options for chemical reactors, in order to arrive at the embodiments of the subject-matter of claim 1 as granted, in which the interior of the condenser is as in the prior art.

- 4.4.3 Hence, the subject-matter of claim 1 as granted is found to lack inventive step and, thus, to violate Article 56 EPC. Accordingly, the main request of the Proprietor must be rejected.

Patent as maintained (first auxiliary request of the Proprietor)

5. Inventive step (Article 56 EPC): claim 1

Claim 1 as maintained differs from claim 1 as granted only in that the SICC duct of the condenser has been further specified by the requirement that it must be external to the condenser's shell (see section IV of the Facts and Submissions above). Even with such restriction, the subject-matter claimed comprises condensers in which tubes of the bundle are possibly used for carbamate circulation, in particular, condensers wherein the gas distribution chamber is as in the condensers of document (3). Hence the reasons given above for the lack of inventive step of the condensers encompassed in claim 1 as granted apply equally to the subject-matter of claim 1 as maintained.

Accordingly, the first auxiliary request of the Proprietor to uphold the decision under appeal to maintain the patent in amended form must also be rejected.

Second auxiliary request of the Proprietor

6. Articles 54, 84, 123(2) and (3) EPC

6.1 The set of claims of the second auxiliary request only differs from that of the granted patent in that independent claims 1 and 6 have been restricted by the introduction of the requirement that the tube bundle is to be used exclusively to carry out the condensation (see section VII of the Facts and Submissions above).

It is apparent to the Board from the reasons discussed above at point 4.3.4 that such formulation necessarily implies the presence in the claimed condensers and retrofitting methods of further technical measures, such as the appropriate dimensioning of the gas distribution chamber, suitable for producing in combination with the SICC duct the exclusive use of the tube bundle for the condensation.

6.2 The Board is satisfied that this amendment complies with the requirements of Articles 54, 84, 123(2) and (3) EPC. As the Opponent has presented no objection in respect of these requirements of the EPC no reasons need be given.

7. Inventive step (Article 56 EPC)

7.1 The Opponent has objected to this request due to lack of inventive step. It has argued that the claimed subject-matter would result in an obvious manner from the combination of documents (3) and (1).

In the opinion of this Party a skilled person aiming at improving the heat exchange and thus the yield of the condensers of document (3) knows already from document (3) itself that the tubes used for circulation would not contribute to the condensation or, thus, to the yield.

The skilled person would then also find in document (1) the explicit instruction that the use of a downcomer - i.e. a coaxially arranged SICC duct - for the circulation of the carbamate solution favours heat exchange. Indeed, document (1) discloses a "combi-reactor" whose condenser section is described, *inter alia*, at page 7, lines 3 to 18, reading "*The gas/liquid mixture which evolves subsequently passes through the condenser tubes, where the exothermic carbamate reaction takes place. ... A proportion of the carbamate formed can be returned to the bottom of the condenser section with the aid of a funnel. Carbamate circulates in the condenser section as a result of the density difference between the carbamate stream in the downcomer and the carbamate/gas mixture in the tubes. This ensures intimate mixing of the carbamate in the condenser section and generates turbulence, which is favourable for heat transfer*". The same is repeated in the description of the apparatus of figure 5 given at page 18, lines 4 to 22, whose last five lines read

"...This funnel ensures further circulation of liquid across the condenser section via the downcomer. This is advantageous in that it promotes heat transfer in the condenser section". The fact that this citation relates mainly to a "combi-reactor" would not influence the skilled person's choice: knowing that the reactor section would not be present in the condenser of document (3), the skilled person would just disregard the upper section of the downcomer exemplified in document (1). Therefore it would be obvious for the skilled person also to create a downcomer in the condensers of document (3) and, to use all the tubes in the bundle for condensation as already disclosed in document (1), and thereby to arrive at the condensers of the claim 1 under consideration, in which the SICC duct is coaxially arranged to the condenser shell. In the opinion of the Opponent a similar reasoning applied also to the minor variations of the same concept, all within the common general knowledge of the skilled person, that lead to the obvious further modifications of using an external SICC duct and of adding on the top of the condenser a tank already designed for connection with the SICC duct, rather than creating another opening in the upper bottom of the condenser.

- 7.2 The Board considers that even if one assumes, for the sake of an argument favourable to the Opponent, that the person skilled in the art aiming at a yield increase in the condenser of document (3) would search in the technical field of "combi-reactors" and would, thus, find document (1), still the combination of these two citations would not render obvious the subject-matter of the claims of the second auxiliary request.

Indeed, the fact that document (3) explicitly acknowledges that the peripheral tubes of the bundle are not used for condensation reaction but for carbamate circulation, does not equate to a statement that this arrangement negatively affects the condenser yield.

Moreover, even though the Opponent's interpretation of the disclosure of document (1) - i.e. that this latter discloses the use of the tubes of the bundle only for condensation and the positive influence in terms of heat exchange produced by the circulation downwards via the downcomer - appears correct to the Board, still this citation, too, is silent as to the advantages in terms of yield (or of heat exchange surface) associated with the exclusive use of the tubes of the bundle for the carbamate condensation. Indeed, the cited passages of document (1) possibly appear to suggest to the skilled reader, for instance, how to achieve an improvement in heat exchange in the condensers of document (3) by simply adding therein a downcomer further favouring the circulation of the carbamate solution. The same passages, however, indicate to the skilled reader of document (1) no reason for modifying the condenser of document (3) so as to produce the result that the reacting mixture flows upwards through all the tubes in the peripheral part of the bundle. Indeed, document (1) neither explicitly indicates nor unambiguously implies what measures have been applied e.g. in the combi-reactor of figure 5 to ensure the exclusive use of the tubes for the condensation, or that this arrangement allows a maximization of yield to be achieved. In particular, nothing in this citation suggests to the skilled person that the **simultaneous**

presence of a downcomer and of e.g. **a gas distribution chamber covering the whole cross section of the condenser** favours the maximization of the yield obtainable from a condenser of given dimensions.

Hence, the documents (3) and (1) do not suggest to the skilled reader the possibility of increasing the yield of the condensers of the prior art by means of the combined application therein of a SICC duct and of other measures, as being necessary for ensuring the exclusive use of all the tubes of the bundle for the condensation.

Accordingly, the condenser claimed in claim 1 of the second auxiliary request and the preferred embodiments thereof defined in claims 2 to 5 of this request, all of which imply the necessary presence of further technical measures suitable for producing in combination with the SICC duct the exclusive use of the tube bundle for the condensation, cannot possibly have been rendered obvious by the available prior art.

7.3 Of course, the same reasons apply *mutatis mutandis* to the method for retrofitting condensers described in claim 6 of the same request.

7.4 Therefore, the Board concludes that the subject-matter of the claims of the second auxiliary request involves an inventive step and, thus, that this request complies with the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the First Instance with the order to maintain the patent in amended form on the basis of claims 1 to 6 of the second auxiliary request and the description to be adapted thereto.
3. The appeal of the Opponent/Appellant I is dismissed.

The Registrar:

The Chairman:

G. Rauh

E. Bendl