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Datasheet for the decision of 27 June 2023

Case Number:	T 2673/19 - 3.3.07
Application Number:	10800848.3
Publication Number:	2519509
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Language of the proceedings:	EN

Title of invention:

METHOD OF CONTROLLING THE PRODUCTION OF SILVER CHLORIDE ON A SILVER CATALYST IN THE PRODUCTION OF ALKYLENE OXIDES

Patent Proprietor:

Dow Technology Investments LLC

Opponents:

BASF SE
Scientific Design Company Inc.

Headword:

Alkylene oxides production / DOW

Relevant legal provisions:

EPC Art. 56
RPBA Art. 12(4)

Keyword:

Inventive step - main request (no) - auxiliary requests 1, 9-11 (no)

Late-filed requests 2-8 - admitted (no)

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Case Number: T 2673/19 - 3.3.07

DECISION
of Technical Board of Appeal 3.3.07
of 27 June 2023

Appellant: (Patent Proprietor)	Dow Technology Investments LLC 2020 Dow Center Midland, MI 48674 (US)
Representative:	Beck Greener LLP Fulwood House 12 Fulwood Place London WC1V 6HR (GB)
Appellant: (Opponent 1)	BASF SE Carl-Bosch-Str. 38 67056 Ludwigshafen (DE)
Representative:	BASF IP Association BASF SE G-FLP-C006 67056 Ludwigshafen (DE)
Appellant: (Opponent 2)	Scientific Design Company Inc. 49 Industrial Avenue Little Ferry New Jersey 07643-1901 (US)
Representative:	Hoefer & Partner Patentanwälte mbB Pilgersheimer Straße 20 81543 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 16 July 2019 concerning maintenance of the European Patent No. 2519509 in amended form.**

Composition of the Board:

Chairman	M. Steendijk
Members:	E. Duval
	L. Basterreix

Summary of Facts and Submissions

I. The appeals were filed by the patent proprietor (appellant P) and opponent 2 (appellant O2) against the interlocutory decision of the opposition division finding that, on the basis of auxiliary request 5, the patent met the requirements of the EPC.

The decision was based on the patent as granted as main request, and on auxiliary request 1 and 2-5 filed respectively as auxiliary requests 1 and 6-9 on 5 April 2019.

II. In particular, claim 1 was identical in auxiliary requests 1 and 2 and pertained to

"A process for reducing the formation of silver chloride on a high-efficiency silver catalyst used in the production of an alkylene oxide from a reactor feed gas comprising an alkylene, oxygen, and at least one organic chloride, the process comprising controlling the concentration of sulfur in the reactor feed gas on an atomic basis to no more than 30 ppbv;
wherein the step of controlling the concentration of sulfur in the reactor feed gas comprises:
(i) selectively fluidly coupling at least one feed gas source to the process; or
(ii) providing an alkylene feed comprising the alkylene and sulfur-containing compounds, and desulfurizing the alkylene feed."

In claim 1 of auxiliary request 5, the step of controlling the concentration of sulfur in the reactor feed gas was limited as follows:

"wherein the step of controlling the concentration of sulfur in the reactor feed gas comprises:
providing an alkylene feed comprising the alkylene and sulfur-containing compounds, and desulfurizing the alkylene feed,
wherein the step of desulfurizing the alkylene feed comprises adsorbing at least a portion of the sulfur-containing compounds on an adsorbent bed,
wherein the adsorbent bed comprises a hydrogen sulfide adsorbing material,
wherein the step of desulfurizing the alkylene feed comprises converting at least a portion of the sulfur-containing compounds to hydrogen sulfide, and adsorbing at least a portion of the hydrogen sulfide on the adsorbent bed."

III. The opposition division found in particular that auxiliary requests 2-4 did not meet the requirements of inventive step. Starting from the closest prior art R1 (GB 2460514), the problem to be solved was the provision of an alternative process, because the problem of providing an improved catalyst was not solved over the whole claimed scope. The claimed solution did not involve an inventive step.

As to auxiliary request 5, since the prior art did not disclose or suggest the claimed steps of conversion of sulfur impurities into hydrogen sulfide (H_2S) and adsorption on an adsorbent bed, the requirements of inventive step were met.

IV. With their grounds of appeal, appellant O2 filed R23-R27:

R23: Kirk-Othmer Encyclopedia of Chemical Technology, Fourth Edition, Vol 23, 1997, pages 267-271

R24: Z. Gao et al., Simultaneous Removal of COS and H_2S at Low Temperatures over Nanoparticle α-FeOOH Based Catalysts, Journal of Natural Gas Chemistry 12(2003), pages 37-42
R25: DD 116 208
R26: US 2008/0227631 A1
R27: US 5,302,470

V. With their grounds of appeal, appellant P filed R28:

R28: Experimental Report prepared by Dr A. Liu (filed as R23)

Appellant P also filed a main request and auxiliary requests 1-11, wherein:

- the main request and auxiliary request 1 corresponded to auxiliary requests 1-2 underlying the decision (see II. above),

- in auxiliary requests 2-5, claim 1 mandated that the sulfur concentration be controlled to no more than 20 ppbv, and differed from the main request by the following additional features:

claim 1 of auxiliary request 2:
"wherein:
(a) the alkylene oxide process is operated for an activation period of at least six days and the concentration of sulfur in the reactor feed gas on an atomic basis during activation is controlled to no more than 20 ppbv,
or
(b) the alkylene oxide process is operated for an activation period of at least two days, the concentration of sulfur in the reactor feed gas on an

atomic basis during activation is controlled to no more than 20 ppbv, and the concentration of sulfur in the reactor feed gas is maintained at the foregoing level for a period of time that is at least seven days"

claim 1 of auxiliary request 3:
"wherein the concentration of sulfur in the reactor feed gas on an atomic basis during activation of said catalyst is controlled to no more than 20 ppbv, and the concentration of sulfur in the reactor feed gas is maintained at the foregoing level for a period of time that is at least seven days"

claim 1 of auxiliary request 4:
"wherein the alkylene oxide process is operated for an activation period of at least six days, the concentration of sulfur in the reactor feed gas on an atomic basis during activation is controlled to no more than 20 ppbv, and the concentration of sulfur in the reactor feed gas is maintained at the foregoing level for a period of time that is at least seven days"

claim 1 of auxiliary request 5:
"wherein the step of controlling the concentration of sulfur in the reactor feed gas on an atomic basis to not more than 20 ppbv is carried out for the duration of the process"

- Claim 1 of auxiliary request 7 differed from the main request as follows: "~~comprising~~ consisting of controlling the concentration of sulfur in the reactor feed gas on an atomic basis to no more than ~~30~~ 20 ppbv".

- Auxiliary 6 and 8 respectively corresponded to auxiliary requests 5 and 7, wherein the alternative of claim 1: "(i) selectively fluidly coupling at least one feed gas source to the process" was deleted.

- Auxiliary request 9 corresponded to the auxiliary request 5 underlying the decision and upheld by the opposition division (see II. above).

- Auxiliary request 10 corresponded to auxiliary request 9, wherein the sulfur concentration was controlled to no more than 20 ppbv. Auxiliary request 11 further specified that "the high-efficiency silver catalyst is rhenium promoted".

VI. The Board set out its preliminary opinion in a communication under Article 15(1) RPBA.

VII. Oral proceedings were held before the Board in the presence of appellant P, appellant O2, and opponent 1 who is a party as of right in the appeal proceedings.

VIII. Appellant P's arguments may be summarized as follows:

(a) Main request and auxiliary request 1, inventive step

Starting from the closest prior art R1, the claimed process differed by the control of the concentration of sulfur to no more than 30 ppbv. Controlling the sulfur concentration below the threshold sulfur value of 30 ppbv resulted in a reduced deposition of silver chloride, which led to an improved performance of the catalyst. The problem to be solved was the provision of a process for the production of an alkylene oxide with an improved catalyst performance. There was no pointer in R1 that reducing the sulfur concentration to no more than 30 ppbv could provide an improvement in catalyst performance. Accordingly, the main request satisfied the requirements of inventive step.

(b) Admittance of auxiliary requests 2-8

These requests were provided in reaction to the reasons given in the appealed decision and in case the Board would not consider the technical effect to be provided across the scope of the claim.

(c) Admittance of R23-R27

R23-R27 were late filed, as they should have been presented in the first instance proceedings, at least considering the opposition division's preliminary opinion. Moreover, R23-R27 were not *prima facie* relevant, and R24-R27 were not representative of the common general knowledge. Hence R23-R27 should not be admitted into the appeal proceedings.

(d) Auxiliary requests 9-11, inventive step

The subject-matter of claim 1 of auxiliary request 9 differed from the closest prior art R1 in that the concentration of sulfur was controlled to be no more than 30 ppbv, the process resulting in a reduction of silver chloride formation, and by the claimed step of desulfurizing the alkylene feed comprising converting at least a portion of the sulfur-containing compounds to H_2S, and adsorbing at least a portion thereof on an adsorbent bed. None of R23-R27 disclosed these features. Hence the criteria of inventive step were met.

IX. The arguments of appellant O2 and opponent 1 may be summarized as follows:

(a) Main request and auxiliary request 1, inventive step

R1 anticipated the subject-matter of claim 1 of the main request, because the absence of the mentioning of sulfur in the feed gas in document R1 would be interpreted by the skilled person as the absence of sulfur in that feed gas. To the extent that it constituted a difference over R1, the control of the sulfur concentration in the feed gas to no more than 30 ppbv did not lead to any technical effect over the whole scope of the claim. The technical problem was the provision of an alternative process. The claimed solution was obvious considering the teaching of R1 that sulfur was a catalyst poison even at ppbv levels.

(b) Admittance of auxiliary requests 2-8

The new auxiliary requests 2-8 were not to be admitted into the proceedings, as they introduced new aspects relating to the activation period and raised new issues.

(c) Admittance of R23-R27

The objections based on common general knowledge against granted claim 7, which had been incorporated into claim 1 of auxiliary request 9, had already been raised in appellant O2's notice of opposition, and were not addressed by the opposition division's preliminary opinion. The filing of R23-R27, further supporting this objection, was in direct reply to the reasons of the appealed decision.

(d) Auxiliary requests 9-11, inventive step

The closest prior art R1 already described the presence of an absorbent bed before the epoxidation unit. The differentiating feature of claim 1 of auxiliary request 9 was thus the step of desulfurizing the alkylene feed comprising converting at least a portion of the sulfur-containing compounds to H_2S. This conversion was part of the common general knowledge, as shown in R23 and further supported by R24-R27. The criteria of inventive step were thus not met.

X. Appellant P requests that the decision under appeal be set aside and that the patent be maintained on the basis of the main request, or, alternatively, on the basis of one of auxiliary requests 1-11, all filed with the grounds of appeal.

Appellant P further requests that none of R23-R27 be admitted into the appeal proceedings.

XI. Appellant O2 requests that the decision under appeal be set aside and that the patent be revoked in its entirety.

Appellant O2 further requests that neither auxiliary requests 2-8, nor R28 and the experimental data included on page 18 of appellant P's grounds of appeal dated 26 November 2019, be admitted into the proceedings.

XII. Opponent 1 requests that appellant P's appeal be dismissed, and that neither auxiliary requests 2-8 nor R28 be admitted into the proceedings.

Reasons for the Decision

1. Main request and auxiliary request 1, Inventive step

1.1 The invention

The invention relates to a process for the production of an alkylene oxide from a reactor feed gas comprising an alkylene, oxygen, and at least one organic chloride. It seeks to address the problem of formation of silver chloride on high-efficiency silver catalysts, which causes a decline in activity and requires more frequent catalyst replacement (see paragraph [0011] of the patent). The solution proposed according to claim 1 of the main request is to control the concentration of sulfur in the reactor feed gas on an atomic basis to no more than 30 ppbv.

1.2 The closest prior art

The parties agree that R1 is a suitable starting point for the assessment of inventive step.

R1 discloses an epoxidation process involving a silver catalyst doped with e.g. rhenium, i.e. a high-efficiency catalyst (see page 8, lines 20-21) and a reaction feed comprising an olefin (alkylene), oxygen and a reaction modifier which is most preferably an organic chloride (see page 12, line 19-25, and page 14, lines 27-28). The process comprises a prior purification step (using a spent catalyst) to remove e.g. sulfur-containing impurities (i.e. desulfurizing the alkylene feed, see claim 22) and may comprise a step of fluidly coupling the feed gas source to the process (see page 5, lines 20-21).

1.3 Differentiating feature

Claim 1 of the main request mandates that the concentration of sulfur in the reactor feed gas on an atomic basis be controlled to no more than 30 ppbv. This feature is not directly and unambiguously disclosed in R1, i.e. neither explicitly nor implicitly. The reason why R1 mentions the susceptibility of silver-based catalysts to sulfur poisoning (see page 1, lines 18-20) is because trace sulfur impurities may be present in the hydrocarbon feedstock. Under these conditions, the absence of disclosure of the sulfur content in the feed gas in R1 cannot be equated with a disclosure of the absence of sulfur.

Thus, the subject-matter of claim 1 of the main request differs from the process of R1 in that the concentration, on an atomic basis, of sulfur in the reactor feed gas is controlled to no more than 30 ppbv.

1.4 Technical effect and problem

1.4.1 According to appellant P, the problem to be solved is the provision of a process for the production of an alkylene oxide with an improved catalyst performance. Appellant P relied in this respect on the examples set out in the patent and on the experimental report R28.

The examples of the patent, and runs 1-3 of R28, are carried out under production conditions at 270°C using 14 ppm ethyl chloride and 7 mol% CO_2. The sulfur concentration is estimated at either 15 ppbv or 40 ppbv (see paragraph [0079] of the patent). A comparison of examples 1 and 2 of the patent shows that, with identical activation period conditions, a production for 1 day at 15 ppbv sulfur and 20 days at 40 ppbv sulfur leads to a higher amount of AgCl than a production for 19 days at 15 ppbv (see table 1 on page 18 of appellant P's grounds of appeal).

These results suggests that, under these conditions at least, a lowering of the sulfur content from this estimated 40 ppbv to 15 ppbv reduces the formation of AgCl. The Board accepts that a significantly reduced formation of AgCl will result in an improved catalyst performance.

1.4.2 Appellant O2 and opponent 1 contest that the claimed upper limit in sulfur is associated with any reduction in the formation of AgCl or improvement in catalyst performances over the whole scope of the claim, among others because claim 1 covers processes where the sulfur concentration is controlled for a relatively small amount of time in a lengthy process.

For the reasons given below, the Board concludes that, even if the effect alleged and the technical problem proposed by appellant P are accepted, the claimed solution does not involve an inventive step. It is accordingly not necessary, for the purposes of the present decision, to assess whether the alleged effect is obtained across the scope of claim 1 of the main request. It is also not necessary to detail the reason why the Board admitted appellant P's experimental report R28 and corresponding data included on page 18 of appellant P's grounds of appeal dated 26 November 2019.

1.4.3 The Board however does not accept appellant P's argument that the upper limit of 30 ppbv has particular significance as the threshold sulfur concentration at which the AgCl formation is zero. Appellant P did not provide any demonstration of such a threshold effect, but merely asserted that this value is obtained by extrapolating a plot of the values for the AgCl percentage on the catalyst after shutdown versus the difference in the catalyst's sulfate content reported in the patent examples and the runs in R28, normalising the results for both linear and non-linear dose response relationships and taking the average value. The Board is not convinced by this reasoning based on averaging values taken from conflicting extrapolations. In addition, considering that said examples and runs are carried out under only one set of conditions (see 1.4.1 above) and with only two estimated sulfur concentration values of 15 ppbv or 40 ppbv, and considering the particular sensitivity of the epoxidation process acknowledged in the patent (see paragraph [0010]), the value of 30 ppbv cannot be regarded as a generally applicable threshold value leading to zero AgCl production over the whole scope of claim 1. In fact, the data reproduced by opponent 1 in their reply dated 17 April 2020 (pages 9-10) contradict appellant P's assertion and show that, in a process as claimed using 1 vol.% CO_2 and 2.5-4 ppm ethylene chloride at 235-260°C, a sulfur concentration of 10-20 ppbv still leads to the formation of 0.21 wt% AgCl.

1.4.4 In summary, for the purposes of the present decision, the technical problem is formulated, as suggested by appellant P, as the provision of a process for the production of an alkylene oxide with an improved catalyst performance. Any particular significance of the upper limit of 30 ppbv as an absolute threshold sulfur concentration avoiding AgCl formation is however not acknowledged.

1.5 Obviousness

1.5.1 R1 mentions the problems associated with the presence of impurities in the olefin feed gas, and in particular sulfur impurities (see R1, page 1, lines 12-22):

"However, low levels of impurities still remain in the olefins and can act as catalyst poisons in a subsequent epoxidation process, adversely affecting the performance of the catalyst. Of particular concern are trace sulfur impurities that may be present in the reaction feed. In the production of olefin oxides, such as ethylene oxide, silver-based catalysts are used to convert ethylene and oxygen into ethylene oxide. These silver-based catalysts are especially susceptible to sulfur poisoning even at sulfur quantities on the order of parts per billion levels. The catalyst poisoning impacts the catalyst performance, in particular the selectivity or activity, and shortens the length of time the catalyst can remain in the reactor before having to exchange the poisoned catalyst with fresh catalyst."

1.5.2 In addition, R1 proposes to address this problem by desulfurizing the alkylene feed using a purification zone containing a spent epoxidation catalyst, upstream from the (epoxidation) reaction zone, to reduce the amount of sulfur impurities such as H_2S (see page 2, lines 8-18; fig. 3; page 3, lines 1-7; claims 21 and 22 of R1; example 1).

1.5.3 Thus, R1 explicitly prompts the skilled person to reduce the amount of sulfur in the reaction feed to a level of parts per billion, or lower, as a solution to the problem of avoiding catalyst poisoning and maintaining catalyst performance.

1.5.4 Contrary to appellant P's opinion, the expression "on the order of parts per billion levels" used in R1 (see lines 19-20) would not be read as referring to amounts such as hundreds or thousands of ppbv, but would be understood such that sulfur impurities poison the catalyst already at the level of a few ppbv. This conclusion is not changed by the fact that example 1 of R1 tested the invention with a much higher amount of 2.0 ppmv H_2S, because R1 mentions that "Such a flow of dihydrogen sulfide represents a substantial excess as compared with dihydrogen sulfide concentrations typically experienced in ethylene oxide operation" (see page 18, lines 18-25).

As indicated above, the Board does not regard the particular value of 30 ppbv as being of any particular significance as a threshold value, i.e. it is not shown that the claimed process produces any effect going beyond what the skilled person would expect considering the teaching of R1, namely improved catalyst performances when the sulfur levels are reduced to a few ppbv in the feed gas. It is for that purpose not relevant either whether R1 teaches how or by which mechanism the sulfur impurities exert this detrimental effect on catalyst performances, such as *via* silver chloride formation.

Appellant P also referred to a passage of R1 relating to the desirable presence of sulfur compounds in the process, however this passage does not pertain to sulfur in the feed gas but as co-promoter in the catalyst (see page 10, line 31).

Lastly, appellant P argued that the claim relates to an industrial process wherein the skilled person would strive for an economic balance between purification costs and benefits in terms of catalysts performance, such that the teaching of R1 could not be seen as a motivation to reduce sulfur contents as low as possible. However, the statement regarding the detrimental effect of sulfur even at amounts on the order of parts per billion levels is made in R1 in the context of an industrial process involving precisely means to reduce the sulfur content. There is furthermore no evidence that the process of present claim 1 would strike any optimum cost/benefit balance. This argument is therefore not convincing.

1.5.5 Accordingly, the main request does not meet the requirement of inventive step.

Since claim 1 of auxiliary request 1 is identical to claim 1 of the main request, its subject-matter likewise lacks an inventive step.

2. Auxiliary requests 2-8, admittance

2.1 Appellant P filed auxiliary requests 2-8 for the first time with the grounds of appeal dated 26 November 2019. The admittance of auxiliary requests 2-8 is contested by appellant O2 and opponent 1.

Since the grounds of appeal were submitted before 1 January 2020, the question of the admittance of auxiliary requests 2-8 must be decided on the basis of Article 12(4) RPBA 2007, which gives the Board discretion to hold inadmissible facts, evidence or requests which could have been presented in the first instance proceedings (Article 25(2) RPBA 2020).

2.2 The Board firstly concurs with appellant O2 and opponent 1 that auxiliary requests 2-8 could have been filed in the first instance proceedings. The opposition division had already stated in its preliminary opinion that the subject-matter of claim 1 as granted did not appear to involve an inventive step starting from R1. Appellant P argued that new arguments had been brought forward by the opponents during the oral proceedings before the opposition division. However, as recounted in the minutes (see page 2), the essential arguments for the rejection of auxiliary request 2, in particular regarding the non-achievement of the effect over the whole scope of the claims, were explained during the oral proceedings, following which appellant P was given time to react during several breaks. Appellant P then indicated that they chose to maintain their requests.

2.3 Furthermore, claim 1 of each of the auxiliary requests 2-4 incorporates features pertaining to a duration of the activation period of at least two or six days and/or to an upper limit of 20 ppbv sulfur during activation or during at least seven days. Limitations pertaining to the activation period were never filed during the proceedings before the opposition division, such that the filing of auxiliary requests 2-4 amounts to an attempt to bring a fresh case in appeal proceedings. These amendments should therefore have been submitted during the first instance proceedings.

2.4 As to auxiliary requests 5-8, the amendments made therein *prima facie* give rise to new issues, at least with respect to added subject-matter.

Thus, claim 1 of auxiliary requests 5 and 6 mandate that the step of controlling the concentration of sulfur to not more than 20 ppbv be carried out for the duration of the process. Appellant P did not indicate a proper basis, under Article 123(2) EPC, for these amendments, but made a sweeping reference to the opposed patent as filed as a whole and in particular the examples. It is however not apparent how the examples, which are carried out under specific conditions for a specific amount of time, could be regarded as basis for this amendment under Article 123(2) EPC. Likewise, claim 1 of auxiliary requests 7 and 8 are reformulated such that the process consists of, instead of comprises, controlling the concentration of sulfur to no more than 20 ppbv. Appellant P considers this amendment to amount to the same limitation as auxiliary requests 5-6, such that the same issue arises under Article 123(2) EPC. The Board notes that appellant P did not, at any point in the appeal proceedings, attempt to rebut the above objections under Article 123(2) EPC.

Finally, it is not apparent to the Board that the amendments introduced in auxiliary requests 2-8 modify the assessment of inventive step given above for the main request, which is not based on the duration of the sulfur control step.

As a consequence, the admission into the proceedings of auxiliary requests 5-8 would have implied further issues, in particular added subject-matter, which would contradict procedural economy.

2.5 Accordingly, the Board did not admit auxiliary requests 2-8.

3. Auxiliary requests 9-11

3.1 Auxiliary request 9 is identical to auxiliary request 5 underlying the appealed decision, which was upheld by the opposition division.

In auxiliary request 9, claim 1 requires that the step of controlling the concentration of sulfur in the reactor feed gas comprises desulfurizing the alkylene feed by converting at least a portion of the sulfur-containing compounds to H_2S, and adsorbing at least a portion of the H_2S on the adsorbent bed.

3.2 Admittance of R23-R27

3.2.1 Appellant O2 filed R23-R27 with their grounds of appeal dated 26 November 2019, in order to show that the conversion of the sulfur impurities into H_2S, and the adsorption of H_2S on an adsorbent bed, were known in the prior art. Appellant P objects to the admittance of R23-R27.

The question of admittance of R23-R27 must be decided on the basis of Article 12(4) RPBA 2007.

3.2.2 The Board considers the filing of R23-R27 as an appropriate and timely reaction to developments in the opposition proceedings, and as legitimate attempts to fill in the gaps in arguments previously presented (see the Case Law of the Boards of Appeal, 10th edition, 2022, V.A.5.11.3.b)).

Appellant O2 had already raised, in the proceedings before the opposition division, an objection of lack of inventive step against the above features starting from R1 in combination with common general knowledge (see the notice of opposition dated 7 March 2018, page 24, regarding claim 7 as granted). The Board does not recognise a duty for opponent 2 to provide documentary evidence for the existence of this piece of common general knowledge at this early point, namely even before it was contested.

The Board does not consider either that R23-R27 should have been filed in the first instance proceedings in reply to the positive preliminary opinion regarding the then auxiliary request 9 (see the annex to the summons issued on 12 November 2018, last page), because this opinion did not give any reasoning as to the relevance of the conversion to H_2S/absorption feature.

In these circumstances, the Board sees the filing of R23-R27 as an appropriate and timely reaction to the finding, in the appealed decision, that the prior art did not suggest the conversion of the sulfur impurities into H_2S, and the adsorption of H_2S on an adsorbent bed (see the appealed decision, paragraph 9.2).

3.2.3 Accordingly, the Board admitted R23-R27 into the proceedings.

3.3 Inventive step

3.3.1 Regarding auxiliary request 9, the closest prior art R1 discloses a process comprising a step of desulfurizing the alkylene feed using a purification zone containing a spent epoxidation catalyst to reduce the amount of sulfur impurities, in particular H_2S (see example 1; see 1.2 and 1.5.2 above). The Board concurs with appellant O2 that the presence of an adsorbent bed comprising an H_2S adsorbing material is thus shown in R1.

Claim 1 differs from the teaching of R1 by the control of the sulfur concentration to no more than 30 ppbv, and the fact that the desulfurizing step comprises converting at least a portion of the sulfur-containing compounds to H_2S.

The claimed desulfurizing step is not exemplified in the patent, and is not shown or alleged to lead to any further technical effect or a different technical problem (see 1.4 above).

R23 shows that technology for "the hydrolysis of carbonyl sulfide in gas streams to permit the more ready removal of the sulfur content as hydrogen sulfide" is part of the common general knowledge (see page 268). The skilled person would accordingly consider carrying out such a conversion of carbonyl sulfide, a known impurity in olefin feed gas, into H_2S in the desulfurization and epoxidation process of R1. The skilled person would not be deterred by the further statement of R23 (see page 269) that, "To effectively remove carbonyl sulfide from a gas stream, special alkaline scrubbing liquors are used", because this procedure is only disclosed as an alternative to the carbonyl sulfide hydrolysis mentioned before. Lastly, the disclosure of R1 is not limited to stand-alone systems but merely mentions as an additional advantage the possibility to reduce sulfur contents without any additional equipment. Moreover, figure 3 of R1 shows that systems comprising a further absorbing unit are also considered. The addition of this carbonyl sulfide conversion step is therefore not precluded by R1.

Accordingly, the subject-matter of claim 1 of auxiliary request 9 does not involve an inventive step.

3.3.2 Auxiliary requests 10 and 11 do not overcome this deficiency.

In claim 1 of auxiliary request 10, the sulfur concentration is additionally limited to no more than 20 ppbv. This lower value does not affect the reasoning given above with respect to the 30 ppbv upper limit in the main request.

Claim 1 of auxiliary request 11 additionally mandates that the high-efficiency silver catalyst is rhenium promoted, which is however already disclosed in R1.

Accordingly, auxiliary requests 10 and 11 do not meet the requirements of inventive step either.

Order

For these reasons it is decided that:

The decision under appeal is set aside.

The patent is revoked.

The Registrar:

The Chairman:

Beschwerdekammern des Europäischen Patentamts ✦ Boards of Appeal of the European Patent Office ✦ Chambres de recours de l'Office européen des brevets

B. Atienza Vivancos

M. Steendijk

Decision electronically authenticated