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Datasheet for the decision of 10 February 2023

Case Number: T 0280/20 - 3.3.02

Application Number: 11776271.6

Publication Number: 2621910

IPC: C07D301/04

Language of the proceedings: EN

Title of invention:
IMPROVED EO PROCESS CONTROL

Patent Proprietor:
Shell Oil Company
Shell Internationale Research Maatschappij B.V.

Opponent:
Scientific Design Company, Inc

Headword:

Relevant legal provisions:
EPC Art. 100(c), 123(2)

Keyword:
Amendments - added subject-matter

Decisions cited:
T 1408/04

Catchword:

Europäisches Patentamt
European Patent Office
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Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 0280/20 - 3.3.02

D E C I S I O N
of Technical Board of Appeal 3.3.02
of 10 February 2023

Appellant: (Patent Proprietor 1)	Shell Oil Company One Shell Plaza P.O. Box 2463 Houston, TX 77252-2463 (US)
Appellant: (Patent Proprietor 2)	Shell Internationale Research Maatschappij B.V. Carel van Bylandtlaan 30 2596 HR The Hague (NL)
Representative:	Shell Legal Services IP p/a Carel van Bylandtlaan 16 2596 HR Den Haag (NL)
Appellant: (Opponent)	Scientific Design Company, Inc 49 Industrial Avenue Little Ferry NJ 07643-1922 (US)
Representative:	HGF HGF Limited 1 City Walk Leeds LS11 9DX (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 22 November 2019 concerning maintenance of the European Patent No. 2621910 in amended form.**

Composition of the Board:

Chairman	M. O. Müller
Members:	S. Bertrand
	L. Bühler

Summary of Facts and Submissions

I. The appeals by the patent proprietor and the opponent are against the interlocutory decision of the opposition division, according to which European patent No. 2 621 910 in its form modified on the basis of the then pending auxiliary request 2 and the invention to which it relates meet the requirements of the EPC.

II. In the impugned decision, the opposition division's conclusions included that the claims of the main request and auxiliary request 1 did not meet the requirements of Article 123(2) EPC.

III. In its statement of grounds of appeal, the patent proprietor submitted claim sets of the main request and the first to fourth auxiliary requests.

IV. In its statement of grounds of appeal, the opponent submitted, *inter alia*, that the claims of the main request and the first and second auxiliary requests added subject-matter beyond the content of the application as filed.

V. Since the patent proprietor and the opponent are both appellants and respondents in these appeal proceedings, they are referred to as "patent proprietor" and "opponent" in the decision.

VI. After the opponent and the patent proprietor had filed their replies to the grounds of appeal, the board issued a communication pursuant to Article 15(1) RPBA 2020 in preparation for the oral proceedings, scheduled at the parties' requests. The board gave its preliminary opinion that the claims of at least the

main request and the first to third auxiliary requests were not allowable under Article 123(2) EPC.

VII. The patent proprietor, in a further letter dated 10 January 2023, filed the fifth and sixth auxiliary requests. It informed the board that it would not attend the oral proceedings.

VIII. Oral proceedings before the board were held on 10 February 2023 by videoconference in the absence of the patent proprietor.

IX. The parties' relevant requests are as follows.

- The patent proprietor requested in writing that the decision under appeal be set aside and the patent be maintained as granted (main request). Alternatively, the proprietor requested that the patent be maintained in amended form according to one of the first to fourth auxiliary requests comprising the claims filed with the statement of grounds of appeal and the adapted description filed with the letter dated 10 January 2023 or one of the fifth and sixth auxiliary requests filed with the letter dated 10 January 2023, each comprising claims and an adapted description.

- The opponent requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

X. The opponent's case relevant to the present decision can be summarised as follows. For further details, reference is made to the Reasons.

Main request

- Claim 1 of the main request did not meet the requirements of Article 123(2) EPC.

- The application as filed did not provide any basis for deleting, in claim 1 of the main request, the feature that the presence of water at any point in the catalyst bed was controlled such that the PPH_2O/VPH_2O ratio was less than 0.006.

- The application as filed failed to provide a basis for "*determining a ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) at an axial position (z) in the catalyst bed*" found in claim 1 of the main request.

First auxiliary request

- Claim 1 of the first auxiliary request did not fulfil the requirements of Article 123(2) EPC.

- Like claim 1 of the main request, the application as filed did not provide any basis for deleting, in claim 1 of the first auxiliary request, the feature that the presence of water at any point in the catalyst bed was controlled such that the PPH_2O/VPH_2O ratio was less than 0.006.

- Furthermore, the application as filed did not provide any basis for "*the ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) is determined at multiple position*" found in claim 1 of the first auxiliary request.

Second to sixth auxiliary requests

- Each claim 1 of the second to sixth auxiliary requests did not comply with the requirements of Article 123(2) EPC for at least one of the reasons given for the main request or the first auxiliary request.

XI. The patent proprietor' case relevant to the present decision can be summarised as follows. For further details, reference is made to the Reasons.

Main request

- The deletion of the feature that the presence of water at any point in the catalyst bed was controlled such that the PPH_2O/VPH_2O ratio was less than 0.006 in claim 1 of the main request did not add matter since the claim required the control of water so that the PPH_2O/VPH_2O ratio at an axial position (z) of the catalyst bed was less than 0.004.

- The features "*determining a ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) at an axial position (z) in the catalyst bed*" found in claim 1 of the main request was disclosed in the passage from page 5, line 30 to page 6, line 3 of the application as filed.

First auxiliary request

- The application as filed disclosed the feature "*the ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) is*

determined at multiple positions" on page 5, lines 30-32.

Second to sixth auxiliary requests

- The claims of the second to sixth auxiliary requests met the requirements of Article 123(2) EPC for the same reasons as those given for the main request and/or the first auxiliary request.

Reasons for the Decision

Main request (claims 1 to 8 as granted) - Article 100(c) EPC

1. Claim 1 of the main request reads as follows (emphasis added by the board; strike through and bold text representing deletion and addition respectively compared to claim 1 as filed):

"*1. A process ~~for~~* ***of reducing catalyst selectivity loss rates in*** *the production of ~~an olefin oxide~~* ***ethylene oxide,*** *which process comprises:*

reacting a feed comprising ethylene and oxygen in the presence of a catalyst bed comprising a catalyst bed comprising ~~silver-containing~~ catalyst loaded in a reactor tube ***of an EO reactor containing multiple EO reactor tubes, an EO removal section, a CO_2 absorber section, and a CO_2 removal section, the catalyst comprising silver, cesium, rhenium or compound thereof, and a rhenium co-promoter selected from one or more of lithium, tungsten, molybdenum, chromium, sulfur, phosphorus, boron, and compounds thereof;*** *~~wherein the presence of water at any point in the catalyst bed is controlled such that the ratio of the partial pressure~~*

~~*of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) is less than 0.006*~~.***characterised by:***

(i) determining a ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) at an axial position (z) in the catalyst bed; and

(ii) controlling the presence of water in the EO reactor by utilising one or more of the following epoxidation process steps:

a) increasing cooling of the overhead streams coming from the EO removal section and/or CO_2 removal sections of the plant that return to the EO reactor;

b) diverting less of the recycle gas through the CO_2 absorber section;

c) operating the EO and CO_2 absorber sections at lower temperature;

d) increasing the Gas Hourly Space Velocity at fixed EO production to reduce the water concentration gradient increase in the EO reactor;

e) reducing EO production per unit volume of catalyst to reduce the amount of H_2O formed in the EO reactor; and

f) operating the reactor at higher temperature than required to increase the vapour pressure of water in the EO reactor tubes;

so that the ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water

(VPH_2O) at the axial position (z) is less than 0.004."

In the following, the ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) will be referred to as "the PPH_2O/VPH_2O ratio".

2. As regards the PPH_2O/VPH_2O ratio, claim 1 of the main request requires:

- determination of the PPH_2O/VPH_2O ratio **at an axial position** within the catalyst bed
- controlling the presence of water (in the catalyst bed) so that the PPH_2O/VPH_2O ratio **at the axial position (z)** of the catalyst bed is less than 0.004

The opponent submitted that the application as filed failed to provide a basis for the determination of the PPH_2O/VPH_2O ratio **at an axial position** within the catalyst bed.

2.1 The patent proprietor submitted that this feature was disclosed in the passage from page 5, line 30 to page 6, line 3 of the application as filed.

2.2 This passage reads: "*The following steps provide a full description of the methodology required to calculate the partial pressure of water in the gas phase at multiple positions within the catalyst bed of an EO reactor tube and the vapor pressure of water* ***at each axial position*** *as well. Finally the ratio of water partial pressure to vapour water pressure is calculated so that it can be determined if the water concentration in the gas* ***at each axial position*** *will cause increased selectivity loss*" (emphasis added by the board).

2.3 The above passage of the application as filed refers to "at each axial position". This does not have the same meaning as "at an axial position (z)", which covers one single position. Thus, the term "at an axial position" in claim 1 of the main request adds subject-matter beyond the content of the application as filed. This conclusion was set out in the board's communication under Article 15(1) RPBA 2020 for the second auxiliary request and not contested by the patent proprietor.

For this reason alone, claim 1 of the main request is not based on the application as filed.

3. In claim 1 of the main request (point 1. above), the feature found in claim 1 as filed "*wherein the presence of water at any point in the catalyst bed is controlled such that the ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) is less than 0.006*" was omitted. The opponent submitted that claim 1 of the main request added subject-matter beyond the content of the application as filed for the further reason that the application as filed did not provide any basis for deleting this feature.

3.1 The board finds that the omission of the above feature in claim 1 of the main request adds subject-matter. The term "at any point" found in the discussed feature in claim 1 as filed can be interpreted as meaning "at every point" or "everywhere". The narrower interpretation given by the patent proprietor, namely "at at least one point", is not accepted, in line with T 1408/04 (Reasons, 1). In accordance with that decision, a broad term should be interpreted to include all technically logical interpretations. The board is of the opinion that the term "at any point in the

catalyst bed" includes both interpretations of "at every point in the catalyst bed" and "at at least one point in the catalyst bed", both interpretations being technically logical.

It follows that claim 1 as filed requires the control of the presence of water at every point of the catalyst bed.

In contrast, claim 1 of the main request only requires controlling the presence of water (in the catalyst bed) so that the PPH_2O/VPH_2O ratio at **the axial position (z)** of the catalyst bed is less than 0.004 (see the feature added at the end of claim 1). It no longer requires that the presence of water **at any point** in the catalyst bed, i.e. everywhere in the catalyst bed, be controlled such that the PPH_2O/VPH_2O ratio is less than 0.006. Thus, claim 1 of the main request encompasses embodiments in which the PPH_2O/VPH_2O ratio can be more than 0.006 in some parts of the catalyst bed, contrary to claim 1 as filed. No passage in the remaining part of the application as filed discloses such embodiments. On the contrary, the application as filed (page 2, lines 15-20) discloses that the presence of water at any point in the catalyst bed is controlled so that the PPH_2O/VPH_2O ratio is less than 0.006. Hence also for this reason, claim 1 of the main request adds subject-matter beyond the content of the application as filed.

This conclusion was set out in the board's communication under Article 15(1) RPBA 2020 and not contested by the patent proprietor.

4. The main request is not allowable.

First auxiliary request - Article 123(2) EPC

5. Claim 1 of the first auxiliary request is a combination of claims 1 and 2 of the main request. Compared to claim 1 of the main request, it comprises the additional feature that the PPH_2O/VPH_2O ratio "*is determined at multiple positions within the catalyst bed and the presence of water controlled such that the ratio is less than 0.004 over at least 50 percent of the catalyst bed length*".

6. As regards the PPH_2O/VPH_2O ratio, claim 1 of the first auxiliary request requires:

- determination of the PPH_2O/VPH_2O ratio **at an axial position** within the catalyst bed (same as claim 1 of the main request)
- determination of the PPH_2O/VPH_2O ratio **at multiple positions** within the catalyst bed
- controlling the presence of water (in the catalyst bed) so that the PPH_2O/VPH_2O ratio **at the axial position (z)** of the catalyst bed is less than 0.004 (same as claim 1 of the main request)
- controlling the presence of water (in the catalyst bed) such that the PPH_2O/VPH_2O ratio is less than 0.004 **over at least 50 per cent of the catalyst bed length**

Like claim 1 of the main request, claim 1 of the first auxiliary request still does not contain the limitation that the presence of water **at any point** in the catalyst bed is controlled so that PPH_2O/VPH_2O ratio is less than 0.006. For the same reasons as given for claim 1 of the main request, claim 1 of the first auxiliary request adds subject-matter. This conclusion was set

out in the board's communication under Article 15(1) RPBA 2020 and not contested by the patent proprietor.

7. Furthermore, claim 1 now requires the determination of the PPH_2O/VPH_2O ratio **at multiple positions** within the catalyst bed. The opponent submitted, for the discussion of claim 2 of the main request, that the application as filed did not provide a basis for this feature.

7.1 The patent proprietor submitted that this feature was disclosed on page 5, lines 30-32 of the application as filed.

7.2 The passage from page 5, line 30 to page 6, line 3 of the application as filed reads: "*The following steps provide a full description of the methodology required to calculate the partial pressure of water in the gas phase* ***at multiple positions*** *within the catalyst bed of an EO reactor tube and the vapor pressure of water* ***at each axial position*** *as well. Finally the ratio of water partial pressure to vapour water pressure is calculated so that it can be determined if the water concentration in the gas* ***at each axial position*** *will cause increased selectivity loss*" (emphasis added by the board).

It follows from the above disclosure in the application as filed that the determination of the PPH_2O/VPH_2O ratio is made at multiple positions and at each axial position. The term "at each axial position" in this passage can only refer to the "multiple positions" mentioned beforehand, implying that these multiple positions must be multiple axial positions.

This determination of the PPH_2O/VPH_2O ratio made at multiple axial positions is not required by claim 1 of the first auxiliary request, which only refers to

"multiple positions" without specifying that these "multiple positions" are axial positions. As submitted by the opponent, one of the multiple positions at which the PPH_2O/VPH_2O ratio is determined according to claim 1 of the first auxiliary request may be in the outlet gas as it emerges from the reactor. Such a position is not an axial position as required by the above passage of the application as filed. Thus, claim 1 of the first auxiliary request includes, for the determination of the PPH_2O/VPH_2O ratio, at least one position which is not axial. For this reason, claim 1 of the first auxiliary request adds subject-matter beyond the content of the application as filed, contrary to the requirements of Article 123(2) EPC.

8. Hence at least for these reasons, the first auxiliary request is not allowable.

Second auxiliary request - Article 123(2) EPC

9. Claim 1 of the second auxiliary request is identical to claim 1 of the first auxiliary request, except it contains the following additional feature:

"*wherein the presence of water at any point in the catalyst bed is controlled such that the ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) is less than 0.006.*"

10. As regards the PPH_2O/VPH_2O ratio, claim 1 of the second auxiliary request requires:

- determining the PPH_2O/VPH_2O ratio at **an axial position (z)** in the catalyst bed (same as claim 1 of the main request)

- determination of the PPH_2O/VPH_2O ratio **at multiple positions** within the catalyst bed (as in claim 1 of the first auxiliary request)
- controlling the presence of water (in the catalyst bed) so that the PPH_2O/VPH_2O ratio at **the axial position (z)** of the catalyst bed is less than 0.004 (same as claim 1 of the main request)
- controlling the presence of water (in the catalyst bed) such that the PPH_2O/VPH_2O ratio is less than 0.004 **over at least 50 per cent of the catalyst bed length** (as in claim 1 of the first auxiliary request)
- controlling the presence of water **at any point in the catalyst bed** such that the PPH_2O/VPH_2O ratio is less than 0.006

11. As regards the determination of the PPH_2O/VPH_2O ratio, claim 1 of the second auxiliary request contains the same requirements as claim 1 of the first auxiliary request (see the first two bullet points above). Hence, for the same reason as given above for the first auxiliary request, claim 1 of the second auxiliary request does not meet the requirements of Article 123(2) EPC.

12. The second auxiliary request is not allowable.

Third auxiliary request - Article 123(2) EPC

13. Claim 1 of the third auxiliary request differs from claim 1 of the main request in that the "*process includes a moderator selected from the group consisting of C_1 to C_8 organic halides and the level of moderator is adjusted higher as the water level is lowered during the process of reducing catalyst selectivity loss rates in the production of an olefin oxide*".

14. The additional features of claim 1 of the third auxiliary request do not change the reasons given in the context of added subject-matter for claim 1 of the main request. These reasons thus apply to claim 1 of the third auxiliary request, and claim 1 of the third auxiliary request does not meet the requirements of Article 123(2) EPC. This conclusion was set out in the board's communication under Article 15(1) RPBA 2020 and not contested by the patent proprietor.

15. The third auxiliary request is not allowable.

Fourth auxiliary request - Article 123(2) EPC

16. Claim 1 of the fourth auxiliary request is a combination of claims 1 and 3 of the main request, i.e. it differs from claim 1 of the main request in that "*the ratio of the partial pressure of water (PPH_2O) divided by the vapour pressure of water (VPH_2O) is determined at multiple positions within the catalyst bed and the presence of water controlled such that the ratio is less than 0.004 over the entire length of the catalyst bed*".

17. As regards the PPH_2O/VPH_2O ratio, claim 1 of the fourth auxiliary request requires:

- determination of the PPH_2O/VPH_2O ratio **at an axial position** within the catalyst bed (same as claim 1 of the main request)
- determination of the PPH_2O/VPH_2O ratio **at multiple positions** within the catalyst bed (as in claim 1 of the first auxiliary request)
- controlling the presence of water (in the catalyst bed) so that the PPH_2O/VPH_2O ratio at **the axial position (z)** of the catalyst bed is less than 0.004 (same as claim 1 of the main request)

- controlling the presence of water such that the PPH_2O/VPH_2O ratio is less than 0.004 **over the entire length of the catalyst bed**

18. As regards the determination of the PPH_2O/VPH_2O ratio, claim 1 of the fourth auxiliary request contains the same requirements as claim 1 of the first auxiliary request (see the first two bullet points above). Hence, for the same reason as given above for the first auxiliary request, claim 1 of the fourth auxiliary request does not meet the requirements of Article 123(2) EPC.

19. The fourth auxiliary request is not allowable.

Fifth and sixth auxiliary requests - Article 123(2) EPC

20. Claim 1 of the fifth auxiliary request and claim 1 of the sixth auxiliary request correspond to claim 1 of the second auxiliary request and claim 1 of the fourth auxiliary request, respectively, with the specification that the catalyst is a "*silver-containing catalyst*".

The specification of the catalyst in each claim 1 of the fifth and sixth auxiliary requests does not change the reasons given for each claim 1 of the second and fourth auxiliary requests. These reasons thus apply to each claim 1 of the fifth and sixth auxiliary requests. Each claim 1 of the fifth and sixth auxiliary requests does not meet the requirements of Article 123(2) EPC.

21. The fifth and sixth auxiliary requests are not allowable.

22. None of the patent proprietor's claim requests is allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

N. Maslin M. O. Müller

Decision electronically authenticated