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D E C I S I O N
of 19 June 1997

Case Number: T 0432/94 - 3.3.1
Application Number: 85201249.1
Publication Number: 0183283
IPC: C10G 45/08

Language of the proceedings: EN

Title of invention:
Single-stage hydrotreating process

Patentee:
Shell Internationale Research Maatschappij B.V.

Opponent:
Akzo Nobel N.V.

Headword:
Hydrotreating/SHELL

Relevant legal provisions:
EPC Art. 56, 108, 114(2)
EPC R. 57, 64(b), 65(1)

Keyword:
"Rule 64(b) EPC - not limiting the matter in dispute"
"Inventive step (yes) - non-obvious alternative"

Decisions cited:
T 0021/81, T 0220/83

Catchword:
-



Case Number: T 0432/94 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 19 June 1997

Appellant: Shell Internationale Research Maatschappij B.V.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 24 March 1994
revoking European patent No. 0 183 283 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: A. J. Nuss
Members: P. P. Bracke
R. E. Teschemacher

Summary of Facts and Submissions

I. This appeal is from the Opposition Division's decision revoking European patent No. 0 183 283, which had been granted on the basis of European patent application No. 85 201 249.1, filed on 29 July 1985, on the grounds of lack of inventive step over document (1) (GB-A 2 073 770).

II. The Opposition Division found that the claimed process differed from the process described in document (1) essentially by the choice of alumina as the lower zone catalyst carrier. Since such choice was considered to be obvious from the teaching of document (1) and a surprising effect had not been shown, the claimed process was considered not to be inventive.

III. With a letter dated 6 July 1995 the Appellant (Patentee) filed a set of 12 claims, wherein the only independent claim reads:

"1. A process for catalytically converting pitch-containing residual hydrocarbon oils at elevated temperature and pressure in the presence of hydrogen, wherein

hydrocarbon oils are passed with hydrogen downwardly into a hydrotreating zone over a stacked-bed comprising hydrotreating catalysts, and

separating the reaction product from said hydrotreating zone into a hydrogen-rich gas and a liquid residue-containing oil having a reduced sulphur content,

wherein the hydrocarbon oils comprise a mixture containing 5-60%v of residual oils and catalytic cracking feedstock,

which mixture is passed into the hydrotreating zone over a stacked-bed under conditions to convert from 45-75% of the sulphur compounds present to hydrogen sulphide **at a hydrogen partial pressure of between 20 and 75 bar,**

which stacked-bed comprises

an upper zone containing 15-85%v, based on total catalyst, of a hydrotreating catalyst comprising a component from Group VIB of the Periodic Table, a Group VIII metal or metal oxide or metal sulphide, and a phosphorus oxide and/or sulphide **in an amount of 2 to 10% w calculated basis phosphorus content**

and

a lower zone containing 15-85%v, based on total catalyst, of a hydrotreating catalyst comprising a component from Group VIB, a Group VIII metal or metal oxide or metal sulphide and less than 0.5%w of phosphorus **supported on a carrier consisting essentially of alumina.**" (emphasis added)

- IV. At the oral proceedings, which took place on 19 June 1997, both Parties agreed that the feature "consisting essentially of alumina" was to be interpreted as meaning technical-grade alumina wherein impurities did not affect the catalytic effect of the catalyst, and the Respondent recognised that the claimed process was novel over the available prior art.
- V. Although in the written statement setting out the grounds of appeal the Appellant had essentially argued that, by using an alumina carrier in the lower bed, the claimed process showed increased stability and/or activity, which argument was supported by experimental

data, this line of argumentation was not followed in the rest of the appeal proceedings, wherein he essentially argued that the problem to be solved, starting from document (1), was to provide a process for converting 45 to 75% of the sulphur compounds present in a pitch-containing residual hydrocarbon oil to hydrogen sulphide at relatively low hydrogen partial pressures, which could be carried out in existing hydrotreating units, i.e. thus avoiding the use of more expensive high-pressure reaction vessels. Since there was no reason to assume that a person skilled in the art would have chosen the specific combination of the features of present Claim 1, the claimed process was inventive.

VI. The Respondent (Opponent) contested whether such change of argumentation was in line with the requirement of Rule 64(b) EPC. He referred to the case law of the Boards of Appeal requiring Appellants to specify in their statement of grounds of appeal the legal and factual reasons on which they based their case. The Appellant should not be allowed to move away from the position taken in these grounds in the course of the appeal proceedings and to argue on the basis of a quite different factual and legal background.

Furthermore, he submitted that the claimed process could have been derived from document (1), wherein all process features were mentioned.

VII. The requests of the parties to the appeal were as follows:

The Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the set of claims submitted as the main request with the letter dated 6 July 1995.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

The claims filed with the letter of 6 July 1995 meet the requirements of Article 123(2) and (3) EPC. This was never contested by the Respondent. It is therefore not necessary to give detailed reasons for this finding.

3. *Clarity*

Since the Respondent no longer contested the clarity of the claims, it is not necessary to give detailed reasons here.

4. *Novelty*

After examination of the cited prior art, the Board has reached the conclusion that none of the available prior art documents discloses all the features of the claimed process. Since novelty was no longer contested, it is not necessary to give detailed reasons for this finding either.

5. *Inventive step*

5.1 The Board considers document (1) to be representative of the closest state of the art. This has also been accepted by both Parties.

5.2 Document (1) is concerned with the catalytic hydroprocessing of heavy hydrocarbon feedstocks to perform reactions such as hydrodesulfurisation or hydrocracking (page 1, line 3 and 10 to 12) by using two catalysts comprising a refractory support and a metal, metal oxide or metal sulphide of a Group VIB or VIII element (page 1, lines 36 to 45).

This document provides a general teaching of process features suitable for carrying out such hydroprocessing, such as

- the heavy hydrocarbon feedstocks suitable for hydroprocessing (page 1, lines 7 to 10);
- the kind of hydroprocessing reactions, that may be conducted (eg hydrodesulfurisation, hydrocracking and the like) (page 1, lines 10 to 14 and 32 to 35, and page 2, lines 3 to 5);
- the kind of catalyst beds that may be used (eg fixed beds, fluidized beds) (page 2, lines 50 to 51);
- the promoters that may be used in both catalysts (i.e. phosphorus or titanium as metals, oxides or sulfides) (page 2, line 20);
- the kind of refractory support materials that may be used in both catalysts (i.e. alumina, silica, magnesia, zirconia or mixtures thereof) (page 1, lines 55 to 57, and page 2, lines 11 and 12); and
- the hydrogen partial pressure suitable in the hydroprocessing reaction (eg 25 to 190 atm, preferably 90 to 160 atm, most preferably 110 to 140 atm) (page 2, lines 9 to 10).

Additionally, in two examples, the hydroprocessing of heavy hydrocarbon feedstocks over a stacked-bed of two catalysts under a hydrogen partial pressure of 110 and 100 atmosphere respectively is described in the sections "Experimental" and "Example" on page 3, line 41 to page 7, line 6.

- 5.3 In the description of the patent in suit it is explained that, according to the prior art residual oil hydrotreating processes are expensive because of the need for high hydrogen partial pressures, which result in more expensive vessels to cope with the required reduction of deleterious compounds with existing catalysts (page 2, lines 19 to 22), and that the present process has the advantage over such prior-art processes that by using the specific stacked-bed catalyst arrangement defined in Claim 1, large volumes of high sulphur, metal-containing residual oils can be converted into catalytic cracker feed in a single-stage hydrotreating process, which operates well at hydrogen partial pressures below 75 bar, so that no additional high-pressure reactors need be constructed (page 3, lines 5 to 7 and 9 to 11).

It is also said that in the present case the stacked-bed combination of catalysts has increased stability and activity (page 3, lines 12 to 15).

- 5.4 In response to objections raised by the Respondent, the Appellant admitted that the experimental data provided in the patent in suit and in the written statement setting out the grounds of appeal were not suitable for showing increased stability and/or activity (see point 3.2 of the letter dated 6 July 1995).

This led the Appellant to argue that the problem to be solved by the claimed invention consisted in the conversion of 45 to 75% of the sulphur compounds

present in a pitch-containing residual hydrocarbon oil to hydrogen sulphide in existing hydrotreating units, as could be derived from the patent in suit (page 2, lines 26 to 28, in combination with page 3, lines 9 to 27). The Respondent considered this to be an unallowable change of argumentation by virtue of Rule 64(b) EPC (see point VI above).

5.4.1 The Board cannot agree with the Respondent that the Appellant is prevented from arguing his case in this way by his statement of grounds of appeal in which he relied on increased stability or activity of the catalysts. It is true that the Boards have derived from Article 108, third sentence, EPC the principle that Appellants must state in their grounds of appeal the legal and factual reasons why the contested decision should be set aside (see in particular T 220/83, OJ EPO 1986, 249). It cannot, however, be concluded therefrom that an Appellant is bound to this line of argument for the whole appeal proceedings. Such limitation is contained neither in Article 108, third sentence, EPC nor elsewhere in the Convention. Article 108, third sentence, EPC deals with an admissibility requirement, the non-observance of which entails the rejection of the appeal as inadmissible (Rule 65(1) EPC). It does not limit the matter in dispute in appeal proceedings. Such a strict rule would prevent Appellants from reacting appropriately if they come to realise that their original arguments are not convincing. This becomes quite clear from the present case in which the respondent showed that the tests submitted with the grounds of appeal did not justify the conclusions which the Appellant had drawn therefrom. It would be unfair to the Appellant to cut off any further submissions on a different basis which might save his right, in particular if such submissions were based on information already contained in the original disclosure, as in the present case. The general

procedural provisions, such as Article 114(2) and Rule 57 EPC, provide enough flexibility for preventing possible misuse by means of delaying relevant submissions in the proceedings before the EPO. The Respondent did not contend that he had not had a fair chance of replying to the new submissions nor did he request that the case be remitted to the first instance as a "fresh case" within the meaning of the case law concerning Article 111(1), second sentence, EPC (see the decisions cited in Case Law of the Boards of Appeal, 2nd edn, 1996, VI.E.8., 12.4 and 12.5).

Therefore, the Board does not see any reason not to consider the case on the basis of the problem as submitted by the Appellant.

- 5.4.2 According to the present Claim 1, this problem is to be solved essentially by passing pitch-containing residual hydrocarbon oils comprising a mixture containing 5-60%v of residual oils and catalytic cracking feedstock at elevated temperature downwardly into a hydrotreating zone over a stacked-bed as defined in present Claim 1 under conditions to convert 45 to 75% of the sulphur compounds present to hydrogen sulphide at a hydrogen partial pressure of between 20 and 75 bar and separating the reaction product from said hydrotreating zone into a hydrogen-rich gas and a liquid residue-containing oil having a reduced sulphur content.

Since it has been shown, in Example 3, that 65% of the sulphur compounds (page 8, line 34) present in a mixture of pitch-containing residual hydrocarbon oils comprising 25%v of atmospheric residue and catalytic cracking feedstock may be converted to hydrogen sulphide at elevated temperatures and at a hydrogen partial pressure of 59 bar (see the compositions of the feed in Table F and the catalyst systems 1 and 3 described in Table G, in combination with the hydrogen

partial pressure mentioned on page 8, line 32), it has in the Board's view been made credible that the claimed process operates well at hydrogen partial pressures below 75 bar and that, therefore, the process now claimed does indeed solve the problem defined in point 5.4 above.

5.5 It remains to be decided whether, in the light of the teaching of document (1), a skilled person would have chosen the process features according to Claim 1 with a view to converting 45 to 75% of the sulphur compounds present in a mixture containing 5 to 60%v of residual oils and catalytic cracking feedstock.

5.6. The Respondent argued that a skilled person would have done so, since all the features of the process of Claim 1 could have been derived from document (1). More particularly, he submitted that

- the feedstocks described in the patent in suit and those described in document (1) have similar compositions [see Table F in Example 3 of the patent in suit and Table 1 of document (1)],
- the processes described in the patent in suit as well as those described in document (1) are not restricted to a method of hydrodesulfurising feedstocks, but embrace any method of converting feedstocks in the presence of hydrogen, such as hydrocracking (see page 2, lines 3 to 5, of document (1) and page 6, lines 63 and 64, of the patent in suit),
- it was known from document (1) that the exact hydroprocessing conditions depend upon the extent of reaction needed (page 2, lines 5 and 6) and, consequently, that in order to obtain 45 to 75% conversion of the sulphur compounds present in the

feedstock to hydrogen sulphide the process parameters, such as pressure, temperature and catalyst, have to be adapted,

- stacked-beds of catalysts containing phosphorus in the upper zone whilst the lower zones are free of phosphorus were known from Table 4 and page 6, lines 44 to 52, of document (1), and
- alumina and silica are the most commonly used carriers.

Moreover, he submitted that the teaching of page 2, lines 36 to 45, that a higher acidity of the lower zone catalyst increased the hydrocracking activity, suggested that, when hydrodesulfurisation is preferred over hydrocracking, the lower zone catalyst should not contain acidic components such as silica.

- 5.7 However, it is to be noted that this document, which is **predominantly** involved in considerations relating to the influence of the **pore size of catalysts** on the hydroprocessing performance of such feedstocks (page 1, lines 36 to 47, and page 2, lines 24 to 35), gives a very broad teaching of hydroprocessing heavy hydrocarbon feedstocks and provides information only on the hydroprocessing conditions in general (see item 5.2 above), without revealing details of the specific conditions required for carrying out a specific hydroprocessing process, such as the conversion of sulphur compounds into hydrogen sulphide.

Although it is true that the feedstocks mentioned in document (1) may have a similar composition to the ones used according to present Claim 1 and that hydrocracking is not necessarily excluded from the claimed process and hydrodesulfurisation is mentioned

in document (1) as one of the possible hydroprocessing processes of heavy hydrocarbon feedstocks, it is nowhere suggested in document (1) which specific catalysts at which hydrogen partial pressure would enable the conversion of 45 to 75% of the sulphur compounds in a mixture containing 5 to 60%v of residual oils and catalytic cracking feedstock at a hydrogen pressure between 25 and 75 bar.

5.7.1 More particularly, the fact that in document (1) stacked-bed catalysts are described which contain phosphorus in the upper zone whilst the lower zone is free of phosphorus, does not mean that such stacked-bed catalysts are suggested to be useful in the conversion of sulphur compounds. In this respect it is noted that document (1), describing only two examples, wherein the feedstocks were hydroprocessed at 110 and 100 atmosphere respectively, is completely silent about the conversion of sulphur compounds into hydrogen sulphide and, consequently, about the influence a catalyst might have thereon. Therefore, the Board cannot accept that there would be any suggestion as to which catalyst(s) would be efficient to convert sulphur compounds into hydrogen sulphide, let alone at a hydrogen partial pressure below 75 bar.

5.7.2 Moreover, the fact that alumina and phosphorus are mentioned as suitable support material and promoter respectively may not be regarded as a suggestion to use such specific materials as support material or promoter in a process for converting 45 to 75% of the sulphur compounds in a feedstock to hydrogen sulphide, because alumina or phosphorus were not cited as the only support material or promoter, but only as one of several possible materials. Furthermore, such references cannot be considered to suggest that the upper zone catalysts should contain 2 to 10% w of phosphorus as promoter while the lower zone catalyst

should contain less than 0.5% w of phosphorus, or that the lower zone catalyst should be supported on a carrier consisting essentially of alumina.

- 5.7.3 Nor may the teaching on page 2, lines 36 to 45, of document (1) be regarded as a suggestion that the lower zone catalyst should be supported on a carrier consisting essentially of alumina. The fact that it is mentioned there that, when hydrocracking is desired, the lower zone catalyst should have higher acidity, and supports of alumina containing 10 to 70% w silica are exemplified, cannot be considered as a pointer to use a carrier consisting essentially of alumina, since it cannot be deduced from such teaching which kind of support should be used for 25 to 75% conversion of the sulphur compounds of a feedstock to hydrogen sulphide at a relatively low hydrogen partial pressure.
- 5.7.4 Finally, the Respondent argued that it could not be deduced from the data presented in the patent in suit for the catalyst systems 3 and 5 (see Table G) that the stacked-bed catalyst system 3 would be superior to the single bed catalyst system 5. This argument, however, does not affect whether or not it was suggested in document (1) to use the catalyst system defined in Claim 1 in order to enable the conversion of 45 to 75% of sulphur compounds present in a feedstock at hydrogen partial pressure below 75 bar and is, consequently, irrelevant in the present case.
- 5.7.5 For substantiating its argumentation that it would have been obvious to select alumina and phosphorus from the refractory ceramic support materials and promoters respectively, as listed on page 2, lines 12 and 20 of document (1), the Respondent referred to decision T 21/81 (OJ EPO 1983, 15).

It is, however, the essence of that decision that it belongs to the normal activities of a skilled person to select from the materials **which are known as suitable for a certain purpose** the most appropriate one (see reasons 5). Since in the present case it could not be deduced from document (1) that alumina and phosphor would be a suitable carrier and promoter respectively for converting 45 to 75% of the sulphur compounds in a feedstock to hydrogen sulphide, it was not known that they were suitable for the purpose of converting sulphur compounds of a feedstock into hydrogen sulfide and, consequently, reference to this decision does not help the Respondent either.

- 5.8 Consequently, there is no support for the Respondent's argumentation that, when trying to solve the underlying technical problem, a skilled person would have chosen the process features according to Claim 1 of the patent in suit from all the features mentioned in document (1).

Therefore, the subject-matter of Claim 1 as well as that of Claims 2 to 12, relating to preferred embodiments of the subject-matter according to Claim 1, involves an inventive step within the meaning of Article 56 EPC.

Order

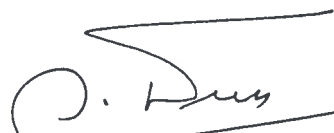
For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent as amended with Claims 1 to 12 submitted as main request with the letter dated 6 July 1995, a description yet to be adapted, and Figures 1 to 5 as granted.

The Registrar:


E. Gorgmaier

The Chairman:


A. Nuss