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D E C I S I O N
of 19 September 2002

Case Number: T 0400/98 - 3.3.6

Application Number: 90908391.7

Publication Number: 0482008

IPC: C10G 65/04

Language of the proceedings: EN

Title of invention:

Catalyst system and process for hydrotreating hydrocarbons

Patentee:

CHEVRON RESEARCH AND TECHNOLOGY COMPANY

Opponent:

Akzo Nobel N.V.

Headword:

LAYERED CATALYST/CHEVRON

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no) - claimed subject-matter encompasses obvious reduction into practice of a generic teaching in the prior art"

Decisions cited:

T 0939/92, T 0220/84, T 0495/91, T 0881/92

Catchword:

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Boards of Appeal

Chambres de recours

Case Number: T 0400/98 - 3.3.6

D E C I S I O N
of the Technical Board of Appeal 3.3.6
of 19 September 2002

Appellant: CHEVRON RESEARCH AND TECHNOLOGY COMPANY
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 23 February 1998
revoking European patent No. 0 482 008 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: P. Krasa
Members: P. Ammendola
C. Holtz

Summary of Facts and Submissions

I. This appeal is from the decision of the Opposition Division to revoke the European patent No. 0 482 008 relating to a layered catalyst system and a process for hydrotreating hydrocarbons for lack of inventive step.

II. The patent as granted comprises 15 claims. Claim 8 is independent and reads as follows:

"8. A process for denitrification of hydrocarbons comprising contacting the hydrocarbons with hydrogen in the presence of a layered catalyst comprising a first layer of a catalyst which comprises a nickel molybdenum-phosphorus/alumina catalyst or a cobalt-molybdenum-phosphorus/alumina catalyst having a molybdenum content greater than about 14 % by weight of the first layer catalyst and having an average pore size of at least about 6 nm (60 Å) and comprising a second layer of a catalyst which comprises a nickel-tungsten/silica-alumina-zeolite or a nickel-molybdenum/silica-alumina-zeolite catalyst, wherein the second layer is placed downstream from the first layer, and the zeolite component comprises at least about 2 % by weight of the second layer catalyst, and wherein the first layer catalyst constitutes up to 70 % by volume of the total catalyst."

Claim 1 is independent and defines the same layered catalyst system described in the process claim 8.

Claims 2 to 7 and 9 to 15 are dependent claims.

III. The Respondent (Opponent) had sought revocation of the patent in its full scope on the ground of Article 100 (a), in particular for lack of novelty and inventive step (Articles 54 and 56 EPC). During the

opposition proceedings the following documents were cited, inter alia, by the parties:

Document (1): EP-A-0 310 165

Document (2): FR-A-2 600 669

Document (5): US-A-3 536 605

Document (6): "Shell 411 Ni/Mo Hydrotreating Catalyst" Technical Bulletin Shell Chemical Company, No. SC:871-87, USA 1987.

IV. In its decision the Opposition Division held that the subject-matter of claim 1 of the patent in suit and that of the sole auxiliary request of the Appellant (Patent Proprietor) lacked an inventive step vis-à-vis Document (1) in combination with Documents (2) and (6).

V. The Appellant appealed against this decision and filed with the statement setting out the grounds of appeal a discussion of the experimental data already considered in the opposition proceedings and a set of 15 claims as first auxiliary request.

The 15 claims of this first auxiliary request are identical to those of the granted patent except for the fact that in claim 1 the term "*hydroprocessing*" has been amended into "*hydrotreating*" and the expression "*in combination with*" has been added between "*6 nm (60 Å) and*" and "*comprising*".

VI. The Respondent replied to the Appellant's statement setting out the grounds of appeal and filed

Document (8): Kirk-Othmer Encyclopedia of Chemical Technology, Vol.17 (1982), pages 201 to 206.

VII. Oral proceedings were held before the Board on 19 September 2002.

At the oral proceedings the Appellant filed a novel set of claims as second auxiliary request. The 8 claims of this request are identical to claims 8 to 15 in the patent as granted (i.e. the Appellant's main request), except they are now numbered as claims 1 to 8.

VIII. The arguments presented orally and in writing by the Appellant with respect to the assessment of inventive step for the subject-matter of claim 1 of the patent in suit can be summarized as follows:

- even though the zeolite-containing catalyst forming the second layer in the claimed catalyst system might *per se* be used for promoting hydrocracking (hereafter indicated as "HCR"), the claimed layered catalyst system promoted hydrodenitritification (hereafter indicated as "HDN") of hydrocarbons and, therefore, was distinguished from the catalysts promoting HCR;

- thus the HDN catalyst disclosed in Document (6) (hereafter indicated as "Shell catalyst") represented prior art more relevant than the HCR catalyst disclosed in Document (1);

- neither the generic disclosure of Document (6) as to the possible combination of HDN with unspecified subsequent HCR units nor its (arbitrary) combination with Document (1) suggested to the person skilled in

the art to replace at least 30% of the Shell catalyst by a zeolite-containing catalyst in order to obtain a novel HDN catalyst with improved activity and stability;

- the above facts were changed by the unavoidable occurrence of some undesired HCR in minor amounts during the HDN process promoted by the claimed catalyst system;
- even in the presence of some contradictions (due to erroneous figures in the examples reported in the patent in suit), the experimental comparisons actually made by the Appellant were described in sufficient detail at least in the discussion of the experimental data filed with the grounds of Appeal and demonstrated that the claimed layered catalyst systems for HDN could not be seen as an arbitrary selection within the general disclosure of Documents (1) or (6).

The Appellant maintained that the reasoning given above for the claimed catalyst system applied as well to the process defined in claim 8 of the patent in suit.

Moreover, the Appellant observed that the process of claim 8 was explicitly characterized as HDN. Since the conditions of HDN and HCR processes (e.g. hydrogen pressure) were in general different, the setting of reaction conditions which ensured the achievement of substantial denitrification in the claimed process differed from the process settings normally used for HCR and hydrocarbon feed.

With respect to claim 1 of the first auxiliary request the Appellant inferred that its subject-matter was more restricted than that of claim 1 of the patent as

granted, maintaining that the wording "catalyst system for hydrotreating" excluded catalyst systems for HCR more clearly than the original expression "catalyst system for hydroprocessing".

- IX. The Respondent refuted the Appellant's reasoning as to the presence of an inventive step for the subject-matter of claim 1 of the main request *inter alia* on the basis of the following arguments.

The person skilled in the art of petroleum refining recognised immediately that the second layer in the catalyst system of claim 1 of the patent in suit was a HCR catalyst and the first catalyst in that of Document (1) was a HDN catalyst.

Therefore, to the eyes of the skilled person the catalyst system defined in claim 1 of the patent in suit and that of Document (1) were, independently on their names, combinations of a HDN catalyst with a HCR catalyst: i.e. catalyst systems for promoting HDN and HCR treatments of the hydrocarbon feed in sequence. Accordingly, Document (1) represented the most relevant state of the art.

The catalyst system defined in claim 1 of the granted patent differed from those in Document (1) (e.g. in the examples of Document (1)) exclusively in the selection of certain parameters for the chemical composition of first HDN catalyst.

It was obvious for the notional person skilled in the art to use the commercial Shell catalyst with improved HDN activity and longer operating cycles described in Document (6) in the catalyst system of Document (1) in order to maximize the economics of HDN.

The same reasoning applied to the claimed process.

The fact that process conditions were optimized for HDN represented no further distinguishing feature of the claimed process vis-à-vis the "HCR" process of Document (1), since substantial HCR of the hydrocarbon feed was produced during the claimed HDN processes as well, as confirmed in the examples provided by the Appellant.

The Respondent alleged that the information provided as to the experimental comparisons carried by the Appellant was too contradictory and/or insufficient to allow any sound conclusion to be drawn as to the reliability thereof. It also contested the possibility of deriving any meaningful information from the fouling rate tests carried out under conditions which were not to be applied for hydrocarbon HDN.

The Respondent further maintained that the claimed catalyst was obvious also when taking the state of the art disclosed in Document (6) as the starting point for evaluating inventive step: the claimed catalyst system was exactly what the person skilled in the art would have arrived at when implementing the instructions in Document (6) as to the possibility of using the Shell catalyst before a subsequent HCR treatment.

In particular, the Respondent stressed that all features characterising the claimed process were conventional and already known e.g. from the examples of Document (1).

At the oral proceedings before the Board the Respondent confirmed that it had no objections as to Article 54 EPC and raised no objection with respect to the late filing of the Appellant's second auxiliary request.

- X. The Appellant requested that the decision under appeal be set aside and that the patent be maintained either with claims 1 to 15 of the patent as granted (main request), or with claims 1 to 15 as filed with the

grounds of appeal (first auxiliary request) or with claims 1 to 8 as filed in the oral proceedings (second auxiliary request).

The Respondent requested that the appeal be dismissed.

- XI. At the end of the oral proceedings the chairman announced the decision of the Board.

Reasons for the Decision

1. *Admissibility of the Appellant's second auxiliary request*

The Appellant filed the set of amended claims forming the second auxiliary request at the oral proceedings before the Board.

Since the claims in this request correspond to the process claims 8 to 15 of the patent as granted (i.e. according to the Appellant's main request) the Board decided to admit this second auxiliary request into the proceedings. The Respondent did not object to the late filing of such request and, therefore, no further reasons need to be given.

2. *The amendments in the first and the second auxiliary requests in view of Articles 84 and 123 EPC.*

Claim 1 according to the first auxiliary request comprises an obvious clerical error at line 7, whose correction is self-evident (i.e. the wording "*in combination with*" was added **between** the words "*and comprising*" instead of **in substitution** thereof).

The Board is satisfied that the set of claims forming the first and the second auxiliary request of the Appellant comply with the requirements of Articles 84 and 123 EPC.

Since all Appellant's requests fail for lack of inventive step it is not necessary to give further details in this respect.

Appellant's main request

3. *Novelty*

The Board is satisfied that the subject-matter of claims 1 to 15 of the Appellant's main request complies with the requirements of Article 54 EPC for the reasons given in the appealed decision.

As the Appellant's request fails for lack of inventive step and the Respondent has no objection with respect to novelty no further reasons need be given.

4. *Inventive step concerning the subject-matter of claim 8*

4.1 Treatments of the hydrocarbon feed occurring in the claimed process

4.1.1 Claim 8 of the Appellant's main request defines a process for denitrification of hydrocarbons with hydrogen, characterized solely by the presence of a layered catalyst system formed by an alumina catalyst of specified composition and porosity placed immediately before a silica-alumina-zeolite catalyst of specified composition, whereby the first catalyst layer constitutes up to 70% by volume of the total catalyst.

4.1.2 In reply to the Respondent's objection that the process of claim 8 was not simply a HDN but rather a HDN/HCR sequential treatment conventional for hydrocarbon refining, the Appellant maintained that the expressions "*catalyst system*" and "*the second layer is placed downstream from the first layer*" in claim 8 implicitly indicated to the skilled reader that the two catalysts must be located one immediately after the other in the same reactor and, therefore, be subjected to the same hydrogen pressure, temperature, feed flow speed, etc..

Moreover, it stressed that claim 8 defined the claimed process as "*denitrification*": this implied that the process parameters (i.e. hydrogen pressure, temperature, contact time, catalyst ratio, etc.) should be regulated only in view of the desired level of hydrocarbon HDN. Since HCR and HDN would normally occur under different conditions (see Document (8) page 205, lines 8 to 10 from the bottom), it would be apparent that, even if the second catalyst layer was a conventional HCR catalyst, in the claimed process this catalyst was exposed exclusively to HDN processing conditions so as to perform substantially only HDN of the hydrocarbon feed.

The Appellant alleged that HCR was a different, undesired process and that also the experimental data provided demonstrated that only a minimum amount of undesired HCR was actually observed in the claimed process. Therefore, it concluded that the two catalysts forming the layered catalyst system performed in the process of claim 8 only one substantial catalytic function: that of promoting denitrification of the hydrocarbon feed.

4.1.3 To determine the real nature of the hydrocarbon treatments occurring during the claimed process the Board considered the common general knowledge of the person skilled in the art which can be drawn from the available state of the art.

From these documents it is apparent that in the technical field of petroleum refining HDN and HCR ,as well as hydrodesulfurisation (HDS) and hydrogenation (HYD), are considered to belong to the same class of hydrocarbon refining treatments since they have a similar nature and occur under similar conditions (see Document (8), page 201, lines 4 to 21).

In particular, it is apparent that the catalysts promoting such reactions are very similar and may produce simultaneously (although normally to different extents) more than one kind of hydrotreatment (see Document (8) page 205, line 7 from the bottom; Document (2) page 9, lines 13 to 20; Document (5) column 1, lines 39 to 52, and column 3, lines 24 to 40).

Moreover, the terms HDN, HCR, HDS, HYD, hydrotreating, hydrorefining, hydroprocessing, etc. have not been used uniformly and consistently to label classes of catalysts or processes, as becomes apparent when comparing:

- the above cited portions of Document (8);
- the prior art discussion at page 2, lines 3 to 15, of Document (1);
- the prior art discussion at column 1, lines 39 to 52, of Document (5) and
- the section with heading "Application" in Document (6).

In addition, even the patent in suit confirms the absence of an univocal nomenclature in this technical field: it implicitly discloses that processes labelled as hydrodenitrification may produce at least partial HCR (see page 2, lines 6 to 8, stating that after HDN the feed may then be subjected "... to the **complete** hydrocracking process.", emphasis added by the Board).

Therefore, the Board considers that the only clear limitation of the claimed subject-matter deriving from the definition of the process of claim 8 as "*denitrification of hydrocarbons*" is that the settings of the process parameters possible in the claimed process are those which result in an at least appreciable reduction of the nitrogen content of the starting feed.

This does not imply however that exclusively denitrification reactions may occur in substantial amounts under such settings of the process parameters.

- 4.1.4 The Board accepts in favour of the Appellant's argumentation that the wording "*catalyst system*" and "*the second layer is placed downstream from the first layer*" in claim 8 reasonably implies for the notional skilled person that the two catalysts must be placed in the same reactor and exposed to the same external conditions.

However, it remains a fact that the catalyst in the reactor first portion is different from that in the second portion. Therefore, the hydrocarbon feed treatments taking place on the two catalyst layers, although occurring under the same external process conditions, may be substantially different.

4.1.5 On the other hand, it is also evident from the common general knowledge implicitly or explicitly mentioned in the available documents that the skilled person may derive from the chemical composition(s) of the catalyst(s) and the process conditions the kind of hydrocarbon treatment(s) actually taking place in substantial amount during hydrocarbon refining.

In particular, the catalysts based on amorphous and relatively basic supports (such as extruded alumina or silica-alumina) with added metals of groups VIB or VIII and possibly containing also phosphorus compounds are known to promote more effectively HDN, HDS and HYD reactions with respect to HCR (see the prior art discussion at page 2 of Document (1), in particular lines 13 to 15; in Document (2) the combination of the disclosure in the sentence bridging pages 4 and 5 with that at page 9, lines 13 to 20, and with that at page 11, line 29 to page 12, line 20).

Catalysts which are based on more acidic crystalline zeolites, such as those similar to the above but additionally containing zeolite and normally not containing any phosphorous compounds, promote instead more effectively HCR (see the prior art discussion at page 2 of Document (1), in particular lines 13 to 15; in Document (2) the combination of the disclosure at page 2, line 10 to page 4, line 9, with that at page 9, lines 25 to 32, and at page 12, line 22 to page 13, line 26).

In addition, the prior art cited above demonstrates that the person skilled in the art was also aware that the catalysts for HCR units are very sensitive to organic nitrogen impurities and therefore that it is often necessary to carry out HDN before HCR (see, for instance, Document (8) page 206, lines 3 to 4, and the section with heading "Application" in Document (6)).

Such processes in which the hydrocarbon feed is subjected to HDN and then to HCR will be indicated in the following as "HDN/HCR sequential treatments".

Finally, from the processes claimed in Document (2) as well as from the discussion of the prior art in these Documents (1) and (2) (see in particular in Document (1) page 2, lines 8 to 16, Document (2) page 6, line 6 to page 7, line 26) it is apparent that HDN and HCR may be combined in a direct sequence, i.e. so that the totality of the effluent of the HDN step are immediately contacted with the subsequent HCR catalyst.

In particular, the notional skilled person finds in Document (1) at page 2, lines 8 to 12, that it is possible to "combine" the HDN/HCR sequential treatments on a single stacked-bed - i.e. layered - catalyst. This single step treatment will be indicated in the following as "combined HDN/HCR sequential treatment".

In view of this disclosure and recalling that the catalyst indicated as "first amorphous hydrocracking catalyst" in Document (1) is evidently a conventional HDN catalyst (see in Document (1) claim 1 and page 1, lines 2 to 13, page 4, lines 42 to 44, page 5, line 44 and Table II), the skilled reader of this document immediately recognises that also the examples of the HCR process given therein are combined HDN/HCR sequential treatments.

- 4.1.6 Similarly to the above, the person skilled in the art recognises that the chemical composition of the second catalyst layer in the process of claim 8 of the patent in suit is that of a HCR catalyst and thus would conclude that the claimed process is a combined HDN/HCR sequential treatment too. This conclusion is further confirmed by following facts:

- even though HCR is generally considered a more severe hydrotreating process than HDN, it is known that both these treatments may be carried out under the same conditions (compare in Document (8) the conditions for HCR in table VIII and the severe conditions for HDN at page 205, lines 14 to 16);
- the conditions defined in the patent in suit for an efficient operation of the claimed processes are substantially those under which both HDN and HCR are known to occur (compare the pressure and temperature ranges given in above cited portions of Document (8) with those given at page 4, lines 34 to 39, of the patent in suit);
- the amount of hydrocarbon cracking measured in the examples of the claimed processes as reported in the experimental data filed with the grounds of appeal (see the "cracking conversions" of about 20 to 30% of the starting feed reported in Table II) are comparable to those observed in processes aiming at hydrocarbon HCR, such as those given in the examples of Document (1).

4.1.7 Therefore, the Board considers that the process defined in claim 8 provides **combined HDN/HCR sequential treatments**, rather than simply "denitrification", of the hydrocarbon feed.

4.2 The closest state of the art.

4.2.1 The relevant state of the art identified in the patent in suit (see page 2, lines 3 to 21) are the HDN treatments of the prior art.

- 4.2.2 In the present case, the fact that the actual nature of the claimed process has not been correctly identified in the patent in suit implies that an inappropriate state of the art was considered.
- 4.2.3 In view of the substantial hydrocarbon HCR occurring in the claimed process, it is instead immediately apparent that the state of the art relevant for the claimed HDN/HCR sequential treatment is to be found among the HDN/HCR sequential treatments of the prior art, rather than among the known processes "*for denitrification of hydrocarbons*" as such.
- 4.2.4 Whereas the Board accepts the Respondent's interpretation of the process disclosed in Document (1) as in fact being a combined HDN/HCR sequential treatment (see above point 4.1.5), it is noted that Document (1) is totally silent as to HDN, the HDN activity of the catalyst and its operating life in the combined HDN/HCR sequential treatments disclosed therein.

On the other hand, the Board observes that Document (6) discloses in general HDN/HCR sequential treatments (see at page 2, the left column). It teaches that the Shell catalyst representing "*the pinnacle of commercial hydrotreating catalysts*" should be used in unspecified HDN/HCR sequential treatments to provide "*additional activity necessary to give low start of run temperatures which provide for longer, more stable operating cycles*". Therefore, the **generic teaching in Document (6) to use the Shell catalyst optimized for improving economics of HDN in unspecified HDN/HCR sequential treatments** offers itself as the most suitable starting point for the assessment of inventive step.

- 4.3 Technical problem solved by the claimed processes

4.3.1 Even taking into account the process features implicit in the definition of present claim 8 (see above points 4.1.3 and 4.1.4) the combined HDN/HCR sequential treatments processes of claim 8 differ from the generic teaching in Document (6) as to the possibility of using the Shell catalyst in conventional HDN/HCR treatments exclusively in the following features:

- the two treatments must be combined, i.e. carried in a single reactor in which the two catalysts are placed one immediately after the other and subjected to the same external conditions (feature I),
- the first (HDN) catalyst layer must comprise not more than 70% of the whole catalyst volume (feature II),
- the second (HCR) catalyst layer must belong to a selected specific class of zeolite-containing HCR catalysts (feature III).

4.3.2 The Appellant observed that the gist of the invention is explicitly defined in the patent in suit (see page 2, lines 22 to 28) as that of providing "*improved economics for hydrotreating processes*", whereby in the patent in suit the term "hydrotreating" is used as equivalent to HDN. It maintained that the experimental data provided showed that the characterising features I to III of claim 8 result in lower start of run temperature and fouling rate with respect to the HDN process based on the Shell catalyst described in Document (6), as well as in comparison to the HDN/HCR sequential treatments according to the generic definition in the same document.

Therefore, the Appellant submitted that the claimed process had credibly solved the technical problem

described in the patent in suit - i.e. providing HDN with improved economics - vis-à-vis all possibly relevant state of the art.

- 4.3.3 As discussed above at point 4.2.4 the relevant state of the art is represented by the generic disclosure of Document (6) as to HDN/HCR sequential treatments. Therefore, to establish whether or not the subject-matter of claim 8 of the patent in suit has credibly solved the problem explicitly mentioned in the patent in suit corresponds to assessing whether or not the level of economics of HDN of the claimed process is superior to that obtained in the HDN/HCR sequential treatments disclosed in general in Document (6).

Thus, the experimental comparison provided by the Appellant and aiming to demonstrate improved HDN economics with respect to "simple" HDN treatments promoted by the Shell catalyst disclosed in Document (6) is not relevant for the assessment of inventive step.

- 4.3.4 On the other hand, convincing evidence that the combined HDN/HCR sequential treatments according to claim 8 provided HDN with superior economics than the HDN/HCR sequential treatments according to the generic teaching of Document (6), would be represented by the experimental comparison of the HDN activity and stability obtained in examples of the claimed processes with those observed in comparative examples of processes representing the reduction into practice of the generic teaching of Document (6), from which the examples according to the invention were distinguished in one or more of features I to III (as defined in point 4.3.1).

However, none of the available experimental comparisons provides such evidence with respect to features I

and III.

In particular in respect to feature III the Board stresses again that, although Document (6) is silent as to the kind of HCR catalyst, the person skilled in the art would reasonably assume that Document (6) referred to conventional HCR units, i.e. those in which the used catalyst inevitably contain some zeolite (see also the common general knowledge mentioned above at and 4.1.5). Instead, in the comparative examples provided by the Appellant to demonstrate the alleged effect of feature III above, the catalyst used in the second layer is catalyst "H", which does not comprise any zeolite at all. Moreover, this catalyst is ambiguously defined as "**also** optimized for hydrocracking" (emphasis added by the Board) at page 1 of the discussion of the experimental data filed with the grounds of appeal. Therefore, this "H" catalyst cannot be considered as representing a conventional HCR catalyst, i.e. a catalyst suitable for realizing an example of the generic teaching of Document (6).

In respect to feature II, the data provided in Table IV of the experimental reports filed with the grounds of appeal - in which examples at 55:45 vol.% ratio of [first catalyst]:[second catalyst] have the same start of run temperature but lower fouling rate than comparative examples at 75:25 vol.% ratio - are contradicted by the values in the left column of the Table at the bottom of page 6 of the patent in suit, in that the 45% and 55% by volume are attribute in opposite order to the first and the second catalyst layers.

The Appellant has maintained that the figures in the Table at page 6 of the patent were erroneous, while those filed in the subsequent submission were alleged to correspond to that in an internal experimental

report of the Appellant from which also the data in the patent were derived. However, the Appellant has not provided a copy of this original experimental report in support of this statement.

Moreover, the Table at the bottom of page 6 of the patent in suit describes in terms of volume % of the first and second layers not only the composition of the invention examples but also that of the comparative examples, thereby casting doubts as to the reliability of their volume ratio too.

Additionally, the method used in these experiments for determining the "fouling rate" were modified to involve lower hydrogen pressures, i.e. higher temperatures, than the HDN conditions (see the definition of the two different testing conditions at page 2 of the discussion of the experimental data filed with the grounds of appeal). The Appellant has provided no arguments as to why such differences in fouling rate observed at these "accelerated" conditions would inevitably correspond to significant differences also under standard HDN conditions. Thus, it is not evident that a corresponding difference is to be expected under the standard HDN conditions as well.

Finally, all provided experimental data are based on a specific HCR second catalyst layer - i.e. the HCR catalyst of Document (5) - having the special property of promoting both HCR and HDN "*concurrently and efficiently*" (see Document (5) e.g. column 6, lines 69 to 71). It is self-evident that the presence of a second catalyst layer with such property may provide a substantial contribution to the level of economics of HDN observed in these examples of the invention.

On the other hand, such special property cannot reasonably be expected for the other conventional HCR

catalysts (such as, for instance, those used in the examples of Documents (1) or (2)), known to promote HCR more efficiently than HDN and falling under the broad definition of the second catalyst layer given in claim 8.

Therefore, the allegedly improved level of economics of HDN (demonstrated by the experimental data in which the (HCR) second catalyst layer is always the catalyst of Document (5)) cannot reasonably be expected also in the other processes according to claim 8, in which the second catalyst layer is different from that of Document (5).

The Board therefore comes to the conclusion that no comparison has been provided with respect to the characterizing features I and III of the claimed process and that the comparison aiming to demonstrate differences in properties resulting from the characterizing feature II are unreliable and/or not sufficient for credibly demonstrating that all processes of claim 8 have actually resulted in the technical effect aimed at in the patent in suit vis-à-vis the HDN/HCR sequential treatments disclosed in general in Document (6).

Thus the level of economics of HDN achieved by the processes of claim 8 has not been credibly demonstrated to be better than the level of economics that Document (6) teaches to derive from the use of the commercial Shell catalyst in conventional HDN/HCR sequential treatments.

4.3.5 According to the case law of the Boards of Appeal of the EPO, the definition of the technical problem to be solved should normally start from the technical problem actually described in the patent in suit in relation to the closest state of the art indicated there. Only if

it turns out that an incorrect state of the art was used or that the technical problem disclosed has in fact not been solved or has not been correctly defined for some reason(s), is it appropriate to consider another problem which objectively existed (see, for example, see T 495/91 of 20 July 1993, No. 4.2 of the Reasons for the Decision, and T 881/92 of 22 April 1996, No. 4.1 of the Reasons for the Decision, neither published in the OJ, as well as other decisions cited in "Case Law of the Boards of Appeal of EPO", fourth edition 2001, page 107, point I.D.4.3).

In the present case, since the technical problem described in the patent in suit has not been credibly solved by the processes of claim 8, the technical problem addressed in the patent in suit must be reformulated.

4.3.6 In the absence of any convincing evidence as to an improved economics of HDN over the other HDN/HCR sequential treatments according to Document (6), the processes of claim 8 in which the first catalyst is the Shell catalyst may credibly solve exclusively the technical problem of **reducing into practice the generic teaching of Document (6)**.

4.4 *Assessment of inventive step for the processes of claim 8 in which the first catalyst layer is the commercial catalyst disclosed in Document (6).*

4.4.1 To answer the question of obviousness it is necessary in the present case to determine what the skilled reader of Document (6) would have done with reasonable expectations of success in order to realize the generic teaching of Document (6).

4.4.2 The Respondent maintained that the person skilled in the art would apply the generic teaching of

Document (6) in HDN/HCR sequential treatments disclosed e.g. in the examples of Document (1), thereby arriving at the claimed subject-matter.

4.4.3 The Appellant submitted that a skilled person would not have combined the technical teachings of Documents (6) and (1) since the latter was totally silent as to the occurrence of any HDN on the first catalyst layer.

4.4.4 However, as already mentioned above at 4.1.3, the skilled person knows that the terms HCR, HDN, etc. have not been used uniformly and consistently.

Thus, the composition of the catalyst used and the process conditions are more apt to identify the actually occurring hydrocarbon treatments than the designations or labels used to this end. Therefore, the person skilled in the art would search the known HDN/HCR sequential treatments to which Document (6) implicitly refers in the whole technical field of hydrotreating, which clearly includes the HCR process of Document (1), and would recognise that the processes disclosed in this document are combined HDN/HCR sequential treatments.

4.4.5 The Appellant further submitted that the simple fact that the person skilled in the art could arrive at the idea of using the Shell catalyst of Document (6) in the processes exemplified in Document (1), was not sufficient to demonstrate that one would have actually done so when attempting to realize the generic teaching of Document (6).

In particular, the Appellant stressed that Document (6) contained no pointer to Document (1), suggesting to the notional skilled person to select among all possible prior art HDN/HCR sequential treatments for hydrocarbon refining exactly those disclosed in the examples of

Document (1).

- 4.4.6 What the person skilled in the art would have done to solve the existing technical problem defined above at 4.3.6 - i.e. reducing into practice the generic teaching of Document (6) - depends obviously on the information given in Document (6). This document instructs the reader that the use the commercial Shell catalyst in unspecified HDN/HCR sequential treatments of hydrocarbon feeds results in improved economics of HDN (see also point 4.2.5 above).

It is implicit in the general nature of the teaching in Document (6) that all known conventional HDN/HCR sequential treatments, including the processes disclosed in the examples of Document (1), are suitable as processes in which to use such a catalyst in order to produce the promised economics of HDN.

The Board agrees with the Appellant that other conventional HDN/HCR sequential treatments different from the examples of Document (1) could as well be used for implementing the generic teaching of Document (6); e.g. one could use the two step process also disclosed in Document (1).

However, all conventional HDN/HCR sequential treatments, irrespective of their number, that a skilled person expected (in the light of Document (6)) to be suitable for reducing into practice the generic teaching of this document, were equally promising candidates for solving such technical problem, and were therefore all equally "suggested" to the skilled person.

To apply one of the possible solutions which were available to the skilled person requires however no particular skills and for this reason does not involve

an inventive step (see e.g. T 939 /92 of 12 September 1995, OJ EPO 1996, 309, No. 2.5.3 of the reasons and T 0220/84 of 18 March 1986, No. 7 of the reasons).

- 4.4.7 The Board therefore comes to the conclusion that at least the processes of claim 8 in which the first catalyst layer is the Shell catalyst of Document (6) are not based on an inventive step and, therefore, that the Appellant's main request does not comply with the requirements of Article 56 EPC.

Appellant's first auxiliary request

5. *Inventive step concerning the subject-matter of claim 8.*

Since claim 8 of the Appellant's first auxiliary request is identical to claim 8 of the main request, the first auxiliary request fails for the same reasons given above for the main request.

Appellant's second auxiliary request

6. *Inventive step concerning the subject-matter of claim 1.*

Since claim 1 of the Appellant's second auxiliary request is identical to claim 8 of the main request, the second auxiliary request fails for the same reasons given above for the main request.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar:

The Chairman:

G. Rauh

P. Krasa