Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 23 February 2023

Case Number: T 0707/21 - 3.3.06

Application Number: 06845095.6

Publication Number: 1960498

IPC: C10G45/00, C10G47/26

Language of the proceedings: EN

Title of invention:
PROCESS FOR UPGRADING HEAVY OIL USING A REACTOR WITH A NOVEL REACTOR SEPARATION SYSTEM

Applicant:
Chevron U.S.A. Inc.

Headword:
PROCESS FOR UPGRADING HEAVY OIL USING A REACTOR WITH A NOVEL REACTOR SEPARATION SYSTEM / Chevron U.S.A. Inc.

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step (all requests) - obvious alternative

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 0707/21 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 23 February 2023

Appellant: (Applicant)	Chevron U.S.A. Inc. 6001 Bollinger Canyon Road San Ramon, CA 94583 (US)
Representative:	Haseltine Lake Kempner LLP One Portwall Square Portwall Lane Bristol BS1 6BH (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 22 December 2020 refusing European patent application No. 06845095.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	J.-M. Schwaller
Members:	P. Ammendola
	S. Fernández de Córdoba

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division to refuse European patent application 06845095.6 because none of the then pending requests complied with the EPC. The examining division held in particular claim 1 of auxiliary request 7 to lack an inventive step (Article 56 EPC) over **D1** (US 2,909,476) in combination with **D3** (US 6,278,034 B1).

II. With the statement of grounds of appeal the appellant filed eight sets of claims labelled as main request and auxiliary requests 1 to 7 and identical to the requests considered in the decision under appeal.

III. In its preliminary opinion, the board held claim 1 of all the requests on file to lack an inventive step in essence for the same reasons as those given in the decision under appeal.

IV. With letter of 17 January 2023, the appellant filed two sets of claims labelled as auxiliary requests 7 and 8, with the latter being identical to auxiliary request 7 filed with the statement of grounds of appeal.

V. At the oral proceedings of 23 February 2023 the appellant reiterated that the decision under appeal be set aside and that the case be remitted to the examining division for further examination on the basis of the claims of the main request, or alternatively on the basis of the claims of one of auxiliary requests 1 to 6, all filed with the statement of grounds of appeal, or of auxiliary request 7 filed with letter of 17 January 2023. In the alternative it requested that a patent be granted on the basis of the sole claim of

auxiliary request 8 filed with letter of 17 January 2023. Further it requested reimbursement of the appeal fee due to an alleged substantial procedural violation.

VI. Claim 1 of the **main request** reads:

"*1. A process for the hydroconversion of heavy oils, said process employing upflow reactors with a separator located internally in at least one reactor, said process comprising the following steps:*

(a) combining a heated heavy oil feed, an active slurry catalyst composition and a hydrogen-containing gas to form a mixture;

(b) passing the mixture of step (a) to the bottom of the first reactor, which is maintained at hydroprocessing conditions, including elevated temperature and pressure;

(c) separating internally in the first reactor a stream comprising reaction product, hydrogen gases, unconverted material and slurry catalyst into two streams, a vapour stream comprising reaction products and hydrogen, and a liquid stream comprising unconverted material and slurry catalyst;

(d) passing the vapour stream overhead to further processing, and passing the liquid stream, comprising unconverted material and slurry catalyst, from the first reactor as a bottoms stream;

(e) passing at least a portion of the liquid stream of step (d) to the bottom of the second reactor, which is maintained at hydroprocessing conditions, including elevated temperature and pressure;

(f) separating internally in the second reactor a stream comprising reaction product, hydrogen gases, unconverted material and slurry catalyst into two streams, a vapour stream comprising reaction products and hydrogen, and a liquid stream comprising unconverted material and slurry catalyst;

(g) passing the vapour stream overhead to further processing, and passing the liquid stream, comprising unconverted material and slurry catalyst, from the second reactor as a bottoms stream to further processing;
wherein the reactors are liquid recirculating reactors."

Claim 1 of **auxiliary request 1** differs therefrom for the appended wording (made apparent):
"*wherein the reactors are liquid recirculating reactors;*
wherein the heavy oil is selected from the group consisting of atmospheric residuum, vacuum residuum, tar from a solvent deasphalting unit, atmospheric gas oils, vacuum gas oils, deasphalted oils, olefins, oils derived from tar sands or bitumen, oils derived from coal, heavy crude oils, synthetic oils from Fischer-Tropsch processes, and oils derived from recycled oil wastes and polymers."

Claim 1 of **auxiliary request 2** differs from that of auxiliary request 1 for the deletion of the "*olefins*".

Claim 1 of **auxiliary request 3** differs from that of the main request for the appended wording (made apparent):
"*wherein the reactors are liquid recirculating reactors;*
in which hydroprocessing conditions employed in each reactor comprise a total pressure in the range from 1500 to 3500 psia (10.34 to 24.13 MPa), and a reaction temperature of from 700 to 900F (371 to 482 °C)."

Claim 1 of **auxiliary request 4** differs from that of auxiliary request 3 for the following amendments (made apparent):

"*in which hydroprocessing conditions employed in each reactor comprise a total pressure in the range from ~~1500 to 3500 psia (10.34 to 24.13 MPa)~~2000 through 3000 psia (13.79 to 20.68 MPa) and a reaction temperature in the range from ~~700 to 900F (371 to 482 °C)~~775 through 850F (413 to 454 °C)*."

Claim 1 of **auxiliary request 5** differs from that of the main request for the appended wording (made apparent):
"*wherein the reactors are liquid recirculating reactors; and*
wherein the catalyst particles have a particle size of 1-10 micron."

Claim 1 of **auxiliary request 6** differs from that of the auxiliary request 4 for the appended wording:
"*wherein the catalyst particles have a particle size of 1-10 micron.*"

Claim 1 of **auxiliary request 7** only differs from that of auxiliary request 3 for the wording (made apparent) added at the end of step "*(d)*":
"*... from the first reactor as a bottoms stream, wherein the vapor stream is the only stream leaving the top of the reactor and the liquid stream is the only stream leaving through the bottom or side of the reactor;*"

The sole claim (claim 1) of **auxiliary request 8** reads as follows:
"*1. A process for hydrocracking of heavy feed, wherein:*
a stream comprising a heavy feed (1) enters a furnace (80) where it is heated,
stream (4) that exits the furnace (80) combines with a hydrogen containing gas (2), recycle slurry (17) and a

stream comprising an active slurry composition (3) resulting in a mixture stream (24),
mixture stream (24) enters the bottom of the first reactor (10),
vapour stream (31) exits the top of the reactor comprising primarily reaction products and hydrogen,
due to a separation apparatus inside the reactor, liquid stream (26), which contains slurry in combination with unconverted oil, exits the bottom or side of reactor (10),
liquid stream (26) is combined with a gaseous stream comprising hydrogen (15) to create a further stream (27),
the further stream (27) enters the bottom of a second reactor (20),
vapour stream (8), comprising primarily reaction products and hydrogen, exits the top of the reactor (20) and joins the vapour product from the first reactor (10),
liquid stream (27), which contains slurry in combination with unconverted oil, exits the bottom or side of the second reactor (20) as a stream (32),
the stream (32) that exits the bottom or side of the second reactor (20) is combined with a gaseous stream comprising hydrogen (16) to create a further stream (28),
the further stream (28) enters the bottom of a third reactor (30),
vapour stream (12), comprising primarily reaction products and hydrogen, exits the top of the reactor and joins the vapour product from the first two reactors,
a liquid stream (17), which contains slurry in combination with unconverted oil, exits the bottom or side of reactor (30),

a portion of stream (17) from the third reactor is recycled back to the first reactor or drawn off as a stream (18),
overhead streams from the first, second and third reactors create a stream (14), which passes to downstream equipment for further processing,
wherein the reactors are liquid recirculating reactors,
wherein pumps are used for recirculation of slurry,
wherein the catalyst particles have a particle size of 1-10 micron,
wherein the process conditions for the liquid recirculating reactors include pressures in the range from 1500 through 3500 psia (10.34 to 24.13 MPa) and temperatures in the range from 700 through 900F (371 to 482°)."

Reasons for the Decision

1. *Auxiliary request 8 - inventive step*

It is noted that this request is identical to auxiliary request 7 refused by the examining division for lack of inventive step of claim 1 over the prior art disclosed in D1 in combination with D3.

1.1 The appellant did not dispute that the prior art process claimed in D1, also depicted in its Fig.1, constitutes a suitable starting point for the assessment of inventive step.

1.2 D1 (column 1, lines 16-23; claim 1) discloses a process for "hydrogenation or hydrocracking of heavy carbon oils" that includes two hydrogenation stages in the presence of a slurry catalyst and hydrogen gas, whereby the oil feed in the first stage undergoes desulfurisation and mild hydrogenation in the presence

of a partially deactivated slurry catalyst and, thereafter, the heavy portion (of the matter exiting the first stage) is subject to a second hydroprocessing stage in the presence of a freshly prepared slurry catalyst.

It is apparent to the board that in the process of claim 1 of D1, also depicted in Fig.1:

- the two identical pressure ranges of "400-2000 p.s.i.g." recited for the two hydrogenation stages at least overlap with the pressure range ("*1500 through 2000 psia*") defined at the end of claim 1 of auxiliary request 8;
- each of the two different temperature ranges of "700°-760° F" and "800°-900° F" respectively recited for the two hydrogenation stages is encompassed by the temperature range ("*700 through 900F*") defined at the end of claim 1 of auxiliary request 8;
- the reactors can be considered "*liquid recirculating reactors*" in the sense of claim 1 at issue (compare the external recirculation lines 7 and 14 in the reactors 1 and 2 of Fig.1 of D1, with the absence of any further description of the expression "*liquid recirculating reactors*" in claim 1 and in the reminder of the application), and
- stream 28 (also passing the pump P_1) allows the recycle to reactor 1 of an at least partially active slurry (see in D1 col.3, lines 37-40, "*... catalyst ... passes through ... line 28 and line 4 to reactor 1 where it is used as partially deactivated catalyst*" emphasis added by the board; see also claim 1 of D1 which describes the occurrence in the first reactor of "*desulfurization and mild hydrogenation conditions*" in the presence of the "partially deactivated catalyst"). This

stream thus can be considered to correspond to the (not further defined) "*stream comprising an active slurry composition*" that claim 1 describes to contribute to the mixture stream fed to the first reactor in the process of claim 1 at issue.

Further, the only catalyst's dimensions disclosed in D1 are (200-400 mesh), i.e. 74-37 micron, and the sole specific example of heavy oil residuum disclosed in this prior art is a "West Texas residuum with an A.P.I gravity of about 18°..." (see the example in D1, column 4, from line 33 onwards).

1.3 The board notes that the application contains not even a mere allegation (not to mention a statement supported e.g. by comparative experimental data or sound theoretical explanations) of any surprising advantage of the process of the invention.

The sole teachings that describe a technical advantage (and thus could identify the technical problem addressed by the invention) are the following ones: "*This invention is intended to perform phase separation within one or more reactors in the process scheme depicted, so that a single vapor phase product is the only product leaving the top of the reactor. A liquid phase product is the only stream leaving the lower portion of the reactor (through the bottom or side) for further processing. If internal separation occurs, there is no need for a hot high pressure separator or flash drum to separate the phase following their exit from the reactor.*" (last paragraph on page 3 of the application), and "*Interstage separation of gaseous reaction products and liquid streams comprising uncoverted oil and catalyst is effective in maintaining heat balance.*" (page 4, lines 17 to 19).

These passages only convey the (self-evident) consideration that the separate withdrawal of a vapour phase (comprising gaseous reaction products) and of a liquid phase (comprising unconverted oil and catalyst slurry) directly from each of the reactors, renders unnecessary the additional use of heat-requiring separators (namely the "*hot high pressure separator or flash drum*") just to fractionate into such phases the products exiting the reactors.

1.3.1 The board stresses that claim 1 at issue specifies neither the nature nor the minimum (absolute or relative) amounts of "*reaction product*" required to be present in the overhead "*vapour stream*"s (lines (31), (8) or (12) in Figure 1 of the present application), or of the "*unconverted oil*" and "*slurry*" required to be present in the "*liquid stream*"s exiting the bottom or side of the reactors (lines (26), (32) or (17) in Figure 1 of the application).

Similarly, also the reminder of the application only describes in general that the "*separator*"s internal to the reactors, also referred to as "*internal separator*"s or "*separation apparatus*"es inside the reactor, enable the desired "*phase separation*" (see page 3, lines 7-8, of the description; as well as the statement on page 4, lines 31-34, that the separation apparatus is responsible for the formation of the vapour stream), and the thereby separated "*vapour stream*"s prevailingly comprise hydrogen and (unspecified amounts of) not further described "*reaction products*", while the separated "*liquid stream*"s contain (unspecified amounts of) unconverted oil and catalyst slurry (see in the application e.g. the "*Summary of the invention*" on page 3, and from the penultimate paragraph on page 4 to the second paragraph on page 5).

Hence, neither claim 1 at issue nor the reminder of the application imply any limitation as to the nature of the "*separation apparatus inside the reactor*" other than those possibly inevitably descending by the requirement that such "*apparatus*" must enable the direct collection of some (i.e. any substantial amount of any) compounds produced by the hydrogenation reaction in a gaseous stream exiting the reactors overhead, and the collection of some (any substantial amount of any) unconverted oil and slurry in a (prevailingly) liquid stream exiting the side or bottom of the reactors.

1.3.2 It is apparent to the board that also in the prior art of departure depicted in Fig.1 of D1 the matters exiting each of the two reactors are separated into:

- a gaseous stream (see in Fig. 1 of D1, lines 21 and 22) exiting the reactor overhead and comprising at least some substantial amount of the compounds produced by the hydrogenation reaction, and
- a liquid stream (see in Fig. 1 of D1 lines 9 and 14) exiting the side of the reactor, and comprising at least some substantial amount of unconverted oil and slurry.

The fact, as stressed by the appellant, that D1 only generically describes the matter going through outlets 21 and 22 as "gasiform material" (see in D1, col.2, lines 62-66 and col. 3, lines 24-28) does not change the fact, self-evident to the skilled reader of Fig.1 of D1, that in each of the depicted reactors the hydrogenation reaction necessarily also produces gaseous or volatile "products".

This is confirmed by the explicit teaching that the gasiform material in line 31 comprises "liquid

hydrocarbons and C_1-C_4 hydrocarbons" as well as "H_2S" (see in D1 col.3, lines 41-55). Of course, these "products" of hydrogenation reactions must necessarily had been present in the streams 21 and 22 that feed line 31, i.e. necessarily also in the "gasiform material" collected overhead from each reactor.

Hence, the board concludes that the reactors in D1 already necessarily also comprise a "*separation apparatus inside the reactor*" in the sense of claim 1.

The board additionally stresses that in the reactors of Fig.1 of D1, such "*apparatus*" can even be identified in the reactor's elongated shape and the provided pair of appropriate outlets, namely:

- a first outlet located in the reactor's top where the matters in gaseous phase (fed to or formed in the reactor) are allowed to spontaneously assembly, due to gravity, and
- a second outlet located in the side of the reactor at a level below that of the liquid phase.

1.3.3 Accordingly, the board finds that the hydrogenation reactors of D1 already provide the relevant phase separation of the matters exiting the reactors into:

- a overhead vapour stream, comprising reaction products and hydrogen, and
- a side or bottom liquid stream, containing unconverted oil and catalyst slurry,

thereby rendering unnecessary additional heat-consuming separators (just) to perform such fractionation.

Thus, the sole technical advantage of the claimed process is found already present in the prior art of departure and therefore cannot be considered in the

formulation of the technical problem solved over the prior art.

1.4 Technical problem solved

1.4.1 The appellant argues that the problem underlying the application would be the provision of a more efficient hydroprocessing process. It derives such conclusion from the following four features of the claimed subject-matter allegedly distinguishing it from the prior art:

(a) the reactors of the invention comprise an internal separation apparatus that allows them to generate overhead of the reactor a vapour stream comprising primarily reaction products and hydrogen, and at the bottom or side of the reactor a liquid stream comprising unconverted oil and slurry;
(b) the liquid stream exiting the first reactor, which contains in combination unconverted product and slurry, is directly fed to the second reactor;
(c) the use of a third hydroprocessing reactor, and
(d) the use of a catalyst with particle size of 1 to 10 micron.

1.4.2 As discussed above, the board finds feature (a) to be already present in D1.

1.4.3 The board also finds it generic and manifestly speculative the appellant's unsupported allegation that for the skilled person also the distinguishing features (b) to (d) would contribute to render the claimed process more efficient than the prior art.

In fact, already the complexity of any hydroprocessing process and the number of variants possibly embraced by the claimed subject-matter render impossible any sound

comparison in terms of e.g. predictable differences in yields and/or in energy consumption between the claimed process and that of the prior art of departure.

This is immediately apparent when considering in particular that claim 1 at issue does not exclude further steps which could consume heat (e.g. in claim 1 not only the stream "(14)" but also the stream "(18)" might be fed e.g. to heat-consuming fractionators).

1.4.4 The board notes on the contrary, that the process of D1 is manifestly designed to ensure that the feed which exits still unconverted the first reactor (i.e. necessarily present in stream 9 of Fig.1 of D1), is subjected to a second hydroprocessing stage. The fact that the process of D1 is designed to allow the use of exclusively fresh catalyst for such second hydroprocessing stage undisputedly contributes to the efficiency of this prior art process.

However, no measure that could allow to ensure a comparable advantage is recited in claim 1 at issue. On the contrary, the embodiments of the claimed process in which the whole fresh catalyst slurry is introduced in the first reactor only, may be expected to allow a less efficient use of the slurry catalytic activity in comparison to the use of the same amount of fresh catalyst in the prior art process.

1.4.5 Hence, the sole technical problem plausibly solved across the whole ambit of claim 1 of auxiliary request 8 vis-à-vis D1 is the provision of a further hydrocracking process, i.e. the provision of whatever alternatives to the prior art of departure, even if manifestly inferior to this latter in some aspects.

1.5 Solution and its obviousness

1.5.1 According to the appellant, even if the technical problem solved is considered to just be the provision of a further hydrocracking process for heavy oils, none of the features (a) to (d) distinguishing the subject-matter of claim 1 would appear obvious in view of D1 *per se* or in combination with D3.

In particular, to arrive at feature (b) (i.e. to modify the prior art so as to directly feed to the second reactor the liquid stream exiting the first reactor, which contains in combination unconverted product and slurry) would require to renounce to the essential feature of the process of D1, namely the use of the fractionator 10 and of the catalyst settler 26 (see Fig.1) which ensures that the slurry exiting the first reactor is not carried further to the second reactor, thereby allowing the use in this latter of exclusively fresh catalyst for hydroprocessing the already desulfurised (but still at least partially unconverted) feed exiting the first reactor. Therefore, only with hindsight would such modification of the prior art appear an obvious solution of the posed problem.

In addition, the appellant pointed to a further feature of the process of claim 1 not present in D1, namely that the initial feed is heated prior to any mixing step (hereinafter this difference is referred to as distinguishing feature **(e)**).

In the appellant's view, none of these distinguishing features would be suggested in the prior art and thus, could represent an obvious solution to the posed technical problem.

1.5.2 As already discussed above, feature (a) is already present in the prior art and thus, is not part of the solution to the posed technical problem offered by claim 1 under consideration.

1.5.3 As to distinguishing feature (b), the board finds that a skilled person aiming at any alternative to the hydrocracking process of D1, including those that are manifestly inferior to this latter can as well consider the possibility to renounce to the advantage in the prior art of departure manifestly descending from the use of more severe hydrogenation conditions (including the exclusive use of fresh slurry) in the second hydrogenation stage and thus, to (renounce to the use of fractionator 10 and catalyst settler 26) and to directly feed into the second reactor the liquid stream with partially deactivated slurry that exits the first reactor. In other words, due to the nature of the technical problem addressed, the skilled person does not need hindsight from the invention or to exercise other inventive ingenuity, in order for simply renouncing to the essence of the advantage of the prior art (and, thus, to arrive at the distinguishing feature (b) of present claim 1). Hence, even such modification of the prior art for the worse, amounts to a routine alternative for modifying the prior art and thus, represents an obvious solution of the posed technical problem.

1.5.4 As to distinguishing feature (c), the board finds that the presence of a third hydroprocessing reactor in the process of claim 1 is just an obvious embodiment of the self-evident option to use series of hydroprocessing reactors (for repeating the hydroprocessing reaction on the not previously converted material). Moreover, such routine option is also already embodied in the prior

art of departure wherein the fraction of the initial residuum oil feed that has not been converted in the first hydroprocessing reactor is fed to the second hydroprocessing reactor as well. The fact that the conditions in the two reactors used in D1 are of different severity does not change the fact that they aim to essentially the same reaction, namely the reaction of heavy oil with hydrogen in the presence of the same catalyst.

Hence, to repeat again the same hydroconversion step on the still unconverted materials in an additional (third) hydroprocessing step also amounts to a routine alternative for modifying the prior art and thus, represents a obvious solution of the posed technical problem, even already indirectly suggested by D1 itself.

1.5.5 As to distinguishing feature (d) the board notes that even though D1 only describes the use of catalyst with a particle size in the range 74-37 micron, the skilled person is aware that catalysts with different particle sizes are also used for hydroprocessing. In particular, D3 teaches (column 2, lines 43-45,) that the catalyst particles used in hydroprocessing heavy oil may have a size distribution between 1 and 250 microns. Since the catalysts with particle size of 1-10 micron are also encompassed among those with a size distribution between 1 and 250 microns, the modification of the prior art of departure required to arrive at the distinguishing feature (d) only requires an arbitrary choice among the possible alternative dimensions of the catalyst particles suggested in D3. Accordingly, such modification of the prior art is a solution of the posed technical problem that is obvious in view of the combination of D1 with D3.

1.5.6 As to distinguishing feature (e) the board stresses that in D1 the feed is also heated before entering in the first reactor, but after having been mixed with slurry and hydrogen (D1, Fig.1, with column 2, lines 36-41). For a skilled person to carry out such heating before the mixing, as now required in claim 1 under consideration, amounts to a routine alternative for modifying the prior art, not involving any inventive ingenuity and thus, represents an obvious solution to the posed technical problem.

1.5.7 The board concludes that the modifications of the prior art necessary to arrive at the subject-matter of claim 1 of auxiliary request 8, that the appellant alleged to be not obvious in view of the prior art, are either not existing (feature (a)), or routine alternatives for modifying the prior art (features (b), (c) and (e)) or result from a modification of D1 that is obvious in view of the disclosure in D3 (feature (d)).

1.5.8 Thus, the appellant failed in rendering plausible that the subject-matter of claim 1 of auxiliary request 8 is not obvious in view of D1 in combination with D3.

1.6 Accordingly, the board sees no reason to reverse the finding of the examining division that the present subject-matter claimed is obvious in view of the prior art. It follows that auxiliary request 8 does not comply with the requirements of Article 56 EPC.

2. For the reasons indicated below it is immediately apparent that none of the other requests on file comply with the EPC. Hence it has also turned out unnecessary for the board to reach a conclusion on:

- the appellant's requests to remit the case to the examining division for further examination of the higher ranking requests, and
- the admittance into the appeal proceedings of auxiliary request 7 (filed after the summons to oral proceedings).

3. *Main request and auxiliary requests 3 and 5*

As already stressed in the board's preliminary opinion the subject-matter of claim 1 of auxiliary request 8 is substantially encompassed by that of claim 1 of the main request. This has not been disputed by the appellant.

Moreover, the additional features in claim 1 of auxiliary requests 3 and 5 (i.e. respectively the catalyst particle size range and the hydroprocessing conditions) that are not already present in claim 1 of the main request, are already present in claim 1 of auxiliary request 8.

Thus, the subject-matter of claim 1 of auxiliary request 8 is also substantially encompassed by that of claim 1 of auxiliary request 3 and that of claim 1 of auxiliary request 5.

Hence, the subject-matter of claim 1 of the main request as well as that of auxiliary requests 3 and 5 are obvious in view of the prior art for substantially the same reasons given in points 1 to 1.5 above.

Accordingly, also the main request and auxiliary requests 3 and 5 do not comply with the requirements of Article 56 EPC and cannot be allowed.

4. *Auxiliary requests 1, 2 and 7*

The features in claim 1 of auxiliary requests 1, 2 and 7 that are not already present in claim 1 of auxiliary request 8 are however undisputedly present in the prior art of departure as well and thus, require no further modification to the prior art of departure to arrive at the claimed subject-matter.

Indeed, it is apparent and undisputed that the "West Texas residuum with an A.P.I gravity of about 18°..." used as heavy oil feed in the example of D1 (see column 4, lines 36-42) is a heavy oil embraced by the list of heavy oils recited at the end of claim 1 of auxiliary requests 1 and 2 (which encompasses, *inter alia*, "*atmospheric residuum*" and "*vacuum residuum*").

It is also apparent and undisputed that also in the reactor 1 of Fig.1 of D1 (and the same applies to reactor 2) there are only two streams of matter leaving the reactor, namely the vapour leaving the top of the reactor (through line 21) and the liquid leaving the side of the reactor (through line 9), as also required in step "*(d)*" of claim 1 of auxiliary request 7.

Hence, also the subject-matter of claim 1 of auxiliary requests 1, 2 and 7 is obvious in view of the prior art for substantially the same reasons given above.

Accordingly, also auxiliary requests 1, 2 and 7 do not comply with the requirements of Article 56 EPC and cannot be allowed.

Auxiliary requests 4 and 6

5. Claim 1 of auxiliary request 4 and that of auxiliary request 6 only respectively differ from that of the main request and that of auxiliary request 5 (already found contrary to Article 56 EPC for substantially the same reasons given for claim 1 of auxiliary request 8) because of the additional requirement of a total pressure of "*2000 through 3000 psia*" and a reaction temperature of "*775 through 850F*". It is stressed that these hydroprocessing conditions are not disclosed in the application to produce any specific advantage or surprising technical effect.

5.1 The board notes that the upper limit of "2000 p.s.i.g." disclosed for the pressure range in both hydrogenation stages in claim 1 of D1 is in accordance with the hydroprocessing pressure required in these versions of claim 1, and the temperature range of "800°-900° F" of the second and more severe hydrogenation stage of D1 is in accordance (in the sense that it overlaps) with the corresponding temperature requirement in claim 1 of auxiliary requests 4 and 6.

Hence, to arrive at the subject-matter of these claims it is necessary to also consider whether the skilled person who was searching for a solution to the posed technical problem would find it obvious to (also) modify the prior art of departure by using in both stages the same temperature that D1 only suggests for the second and more severe hydrogenation.

In the convincement of the board, also in considering such modification, it is of relevance that the skilled person aims at any alternative to the hydrocracking process of D1, including those manifestly inferior to this latter. Hence, the skilled person can as well consider the possibility to renounce to the advantage

in the prior art of departure manifestly descending from the use of more severe hydrogenation conditions (including the exclusive use of fresh slurry) in the second hydrogenation stage and thus, to also use more severe hydrogenation conditions in the first reactor too. In other words, due to the nature of the technical problem addressed, the skilled person does not need hindsight or exercise other inventive ingenuity, in order for simply renouncing to the essence of the advantage of the prior art (and thus, to arrive at using more severe hydrogenation conditions in all the reactors of the prior art). Hence, even if such modification of the prior art is for the worse, it amounts to a possibility for modifying the prior art apparent from D1 itself and thus, also represents an obvious solution of the posed technical problem.

5.2 For this reason as well as for substantially the same reasons given above, also the subject-matter of claim 1 of auxiliary requests 4 and 6 are found obvious in view of the prior art.

Accordingly, also these requests do not comply with the requirements of Article 56 EPC nor can they be allowed.

6. As none of the claims requests complies with the EPC, the appeal is not allowable. Hence, there is also no reason for the board to consider the appellant's request of reimbursement of the appeal fees due to an alleged procedural violation (see Rule 103(1)(a) EPC).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Pinna J.-M. Schwaller

Decision electronically authenticated