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**Datasheet for the decision
of 31 October 2023**

Case Number: T 0464/19 - 3.3.06

Application Number: 14162121.9

Publication Number: 2792732

IPC: C10L3/00, C10L3/10

Language of the proceedings: EN

Title of invention:

METAL CARBOXYLATE SALTS AS H₂S SCAVENGERS IN MIXED PRODUCTION
OR DRY GAS SYSTEMS

Patent Proprietor:

BAKER HUGHES INCORPORATED

Opponent:

Clariant Produkte (Deutschland) GmbH

Headword:

H₂S SCAVENGERS/BAKER HUGHES

Relevant legal provisions:

EPC Art. 56

RPBA Art. 12(4)

Keyword:

Auxiliary request 3 - admitted

Inventive step - (main request and auxiliary requests 1 and 2)

reasonable expectation of success - (auxiliary request 3) ex

post facto analysis

Decisions cited:

Catchword:



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Case Number: T 0464/19 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 31 October 2023

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 29 November
2018 revoking European patent No. 2792732
pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman J.-M. Schwaller
Members: P. Ammendola
J. Hoppe

Summary of Facts and Submissions

- I. The patent proprietor appealed the decision of the opposition division to revoke European patent No. **2 792 732**.

- II. During the written opposition proceedings the opponent (now **respondent**) raised objections under Article 56 EPC starting either from **D9** (WO 02/051968 A1) or **D10** (J. Buller et al., "*H₂S Scavengers for Non-aqueous Systems*", SPE Int. Symp. on Oilfield Chemistry, 2005) and filed **experimental data** with letter of **4 June 2018**. The proprietor (now **appellant**) filed amended claims as **main request** and **auxiliary requests 1 and 2**, and after having received the preliminary opinion that D9 represented the closest prior art it filed experimental data in **Annex A** of the letter of 5 September 2018. During the oral proceedings held on 5 November 2018, after it became apparent that the experimental data of Annex A were considered insufficient to prove a surprising technical effect, the proprietor submitted a new set of amended claims as **auxiliary request 2a**, which was not admitted into the opposition proceedings.

- III. In the appealed decision it was found that claim 1 of the main, first and second auxiliary requests lacked inventive step vis-à-vis the prior art disclosed in D9 in combination with the teachings in **D5** (US 6,599,472 B1) or D10.

- IV. With the grounds of appeal the appellant filed eight sets of amended claims labelled as **main request** and **auxiliary requests 1 to 7**, with the main request and

auxiliary requests 1 to 3 being identical to the main request and auxiliary requests 1, 2 and 2a dealt with in the decision under appeal. It also filed therewith new experimental data.

- V. Claim 1 of the **main request** reads: "*1. A method for at least partially scavenging a contaminant from a hydrocarbon gas containing stream which is a mixed production consisting of oil, a hydrocarbon gas and greater than 50 wt% water, the method comprising: contacting the hydrocarbon gas containing stream with a transition metal carboxylate scavenger in an effective amount to at least partially scavenge a contaminant from the hydrocarbon gas containing stream, where the contaminant is selected from the group consisting of H₂S, a mercaptan, a sulfide and combinations thereof; and at least partially scavenging the contaminant from the hydrocarbon gas containing stream.*"

Claim 1 of **auxiliary request 1** differs therefrom for the appended wording: "*...; where the transition metal carboxylate is selected from the group consisting of zinc octoate, zinc dodecanoate, zinc naphthene, and combinations thereof*".

Claim 1 of **auxiliary request 2** restricts the transition metal carboxylate to "*zinc octoate*".

Claim 1 of **auxiliary request 3** differs from that of auxiliary request 2 for the amendment (made apparent) in the initial portion of the claim: "*... and greater than 5090 wt% water,...*".

- VI. With its reply the respondent requested *inter alia* that auxiliary requests 3 to 7 be not admitted into the appeal proceedings. It also objected to all requests on

file under Article 56 EPC, arguing in particular that claim 1 of the main request and auxiliary requests 1 and 2 was obvious in view of the combination of D10 with D5, and claim 1 according to auxiliary request 3 was obvious in view of the combination of D9 with D10 or D5. It also filed further experimental data.

VII. At the oral proceedings held on 31 October 2023 the debate concentrated on compliance of the subject-matter of claim 1 of auxiliary request 2 with Article 56 EPC, admittance of auxiliary request 3 into the proceedings and compliance of the subject-matter claimed therein with Article 56 EPC. Thereafter, the appellant stated not wishing to put forward further arguments with respect to the inventive step of the main request or auxiliary request 1. The final requests of the parties were as follows:

The appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the claims of the main request or of one of auxiliary requests 1 to 7, all as enclosed to the grounds of appeal.

The respondent (opponent) requested that the appeal be dismissed.

Reasons for the Decision

1. Auxiliary request 2 - Inventive step

1.1 Claim 1 at issue describes a method for at least partially scavenging H₂S, mercaptan or sulfide contaminants from a mixed production consisting of oil, a hydrocarbon gas and at least 50 wt% water by

contacting the mixed production with a transition metal carboxylate that is zinc octoate.

- 1.2 As claim 1 is limited to a method of scavenging sulfur contaminants from "a mixed production consisting of oil, a hydrocarbon gas and greater than 50 wt% water", the passage in paragraph [0010] of the patent, reading: "*It would be desirable if methods and/or compositions could be devised that would, reduce, eliminate, take out or otherwise remove such contaminants from these mixed production...*" (emphasis added by the board), is of particular relevance, as it is to be read in connection with the preceding following preceding passages in par. [0006]: "*...nearly all scavenging systems for removing H₂S, mercaptans and/or sulfides from oil-based systems such as crude oil, oil slurries, asphalt, and the like, cannot be assumed to work in mixed production systems... "Mixed production systems" are defined herein to be predominantly water with some oil present, where the water is greater than about 50 wt% of the mixture,.... A mixed production system may contain a hydrocarbon gas, such as natural gas" (see par. [0005], emphasis added by the board), and "*In other words, it is not obvious or apparent that a scavenger that removes H₂S, mercaptans and/or sulfides from oil-based systems will do so for a mixed production system...Nearly all scavengers that work well for oil-based systems do not work, or do not work very well or very effectively for mixed production systems but might work for dry hydrocarbon gas systems and/or a wet hydrocarbon gas system.... Many conventional H₂S scavengers such as triazine work poorly in mixed production systems where the water content is above 20%" (emphasis added by the board).*"*

The examples and Figure 1 of the patent (see also paragraphs [0013] and [0024]) compare the H₂S scavenging results provided by "a conventional oil soluble amine/formaldehyde reaction product" with those provided by "zinc octoate", with the transition metal carboxylate being therein described as soluble in aromatic solvent (and thus implicitly acknowledged to be oil soluble).

- 1.3 From the above, the board comes to the conclusion that the invention is based on the finding that oil soluble "transition metal carboxylate"s (in particular "zinc octoate") have been found to scavenge H₂S from mixtures of oil and a predominant amount of water (such as the "mixed production" with "greater than 50 wt% water" defined in claim 1), more effectively than other oil soluble compounds already used as H₂S scavengers in systems with a predominant amount of oil (to which the patent in suit refers as "oil-based system"s).

It follows from the above considerations that the skilled reader of the patent would conclude that said passage in paragraph [0010] addresses in particular the technical problem of rendering available a **surprisingly effective** method for scavenging H₂S from production systems which contain a predominant amount of water in addition to oil and hydrocarbon gas.

- 1.4 Closest prior art

The respondent considered, *inter alia*, the prior art disclosed in D10 as a suitable starting point for the assessment of inventive step of the subject-matter of claim 1 at issue.

1.4.1 In this respect, the board notes that D10 discloses scavengers and processes for removing H₂S from oil and gas production streams that are low in water. It also reviews "the properties of a family of new, fast-acting, oil soluble H₂S scavengers based on carboxylates of zinc" (see title and abstract). As correctly stressed by the respondent and undisputed by the appellant, D10 on page 2, bottom left-hand column, lists the "high points" of (a not further described) "zinc carboxylate" also labelled "ZnSoap" observed in the (subsequently described) tests, namely that this compound has been found a particularly effective and quick scavenger that remains also effective in case water is "introduced" into the (presumably previously water-deficient oil and gas production) system treated.

The relevant tests described in D10 are:

- a) a first one (see page 2, starting on the top of the right-hand column and including the first paragraph below Figure 1) in which zinc carboxylate has been found (together with a iron carboxylate) to be the "most effective" in scavenging H₂S from a mineral oil and thus, also more effective than the other tested scavengers, such as e.g. triazine (which undisputedly is a conventional oil soluble H₂S scavengers for oil-based systems);
- b) a second one (see page 2, right-hand column second paragraph below Figure 1) carried out for "16 h", i.e. a time length qualified as "time-extended regime", in which all the scavengers used in the first test - excepted iron carboxylate - have been found to perform "well" in scavenging H₂S from a 50:50 mixture of water and the mineral oil (hereinafter **50:50 water:oil mixture**).

The board stresses that, contrary to the appellant's argument that the disclosure in D10 relating to the second test would appear "out of context" when considering the focus in this citation on water-deficient systems and the "time extended regime" of the tests, the teachings at the bottom of the left-hand column of page 2 (including those relating to the activity of zinc carboxylate also in the presence of added water) appear to the skilled person as logically related to the two rounds of tests described thereafter.

Hence, the board concludes that the second test in D10 discloses that, among the tested H₂S scavengers, zinc carboxylate, namely the compound that had also been found the most effective H₂S scavenger in water-deficient oil systems, performs well even when the water content of the treated oil system is as high as 50 wt%.

1.4.2 In view of the manifest similarity between the H₂S scavenging with zinc carboxylate carried out in the second test of D10, and the subject-matter of claim 1 under consideration as well as the technical problem addressed in the patent (see above), the second round of tests of D10 carried with the 50:50 water:oil mixture in which "ZnSoap" is among the H₂S scavengers that performed "well", is found by the board a suitable starting point for the assessment of inventive step of claim 1.

1.5 The technical problem solved

The appellant argued (in view of the experimental data in the patent and of the further evidence that it provided during the opposition and appeal proceedings)

that zinc octoate had been proven to be a more effective and rapid than other H₂S scavengers in systems containing (exclusively or) prevailingly water. Hence, the technical problem solved by the subject-matter of claim 1 under consideration was to render available an improved method for scavenging H₂S from mixtures of oil and hydrocarbon gas comprising more than 50 wt% water.

The board finds such formulation of the technical problem solved substantially equivalent to the technical problem that the board considered addressed in the patent in suit (see end of point 1.1 above).

- 1.5.1 The respondent argued instead (also in view of the experimental data in the patent and of the further experimental evidence that it provided during the opposition and appeal proceedings) that the technical problem addressed in the patent would not be solved by the subject-matter of claim 1 at issue, which would thus just offer an alternative to the prior art.
- 1.5.2 The board found unnecessary to come to a conclusion as to (the relevance, significance, sufficiency and/or admissibility of the apparently contradictory experimental data submitted by the parties and, thus, as to) which was the technical problem solved across the whole scope of claim 1 at stake, because the respondent rendered plausible that even if the technical problem solved was that identified by the appellant, still the claimed subject-matter would provide a solution thereto that would be obvious in view of the prior art.
- 1.5.3 Hence, in the following the board assumes, for the sake of an argument in favour of the appellant, that the

technical problem solved is to render available an improved method for scavenging H₂S from mixtures of oil and hydrocarbon gas that comprise more than 50 wt% water.

1.6 The solution proposed and its obviousness

The solution proposed in claim 1 of auxiliary request 2 is a method of scavenging H₂S from mixtures of oil and hydrocarbon gas comprising more than 50 wt% water, that uses zinc octoate as scavenger, and so the claimed method differs from the closest prior art identified above in that

- (a) the H₂S scavenger is zinc octoate, and
- (b) the treated system further comprises hydrocarbon gas and more than 50% of water.

As claim 1 however does not require any minimum amount for the hydrocarbon gas and allows for an amount of water that is just above 50 wt%, this claim encompasses embodiments in which the treated "*mixed production*"s are very similar to the 50:50 oil:water mixture of the prior art such as, for instance, "*mixed production*"s in which the amount of hydrocarbon gas in the treated stream can be extremely low (e.g. some ppm) and the water content can be just above 50 wt% .

It is apparent and undisputed that for these embodiments no substantial contribution to the solution of the technical problem can be expected to plausibly descend from such minimal differences in the treated system. Indeed, the appellant did not even merely allege, let aside made it plausible, that an additional presence of e.g. such a low amount of hydrocarbon gas and of an amount of water of just above 50 wt% in the mixed production treated in claim 1, could be expected

to substantially influence the efficacy of the scavengers in comparison to the treated system with the 50:50 oil:water mixture used in D10. On the contrary, since hydrocarbon gas and water are indisputably both normally present in the streams produced and treated in the petrochemical technical field, it is apparent that the minimal modifications of the 50:50 oil:water mixture of the prior art, required to arrive at mixed productions in accordance with claim 1 under dispute would be regarded by the skilled person as technically irrelevant variations, not requiring any inventive ingenuity.

Hence the sole difference between the subject-matter of claim 1 and the prior art that may involve an inventive step, is indisputably represented by the use of zinc octoate.

- 1.6.1 Accordingly, in the present case the assessment of inventive step boils down to the question whether a skilled person starting from the second round of tests of D10, finds teachings in the prior art that render obvious to expect that zinc octoate would provide in the 50:50 oil:water mixture, superior results in comparison to other conventional H₂S scavengers (such as e.g. triazine) tested in this prior art.

In fact, if this question is answered in the positive, then the skilled person would also expect zinc octoate to provide substantially the same superior results also when treating any mixture very similar to the 50:50 oil:water mixture, only differing from the latter for e.g. some detectable traces of hydrocarbon gas and some detectable additional water. Hence, if the above question is answered in the positive, then also the embodiments of the subject-matter of claim 1 under

dispute that use "*mixed production*"s that differ only minimally from the 50:50 oil:water mixture of the prior art, would result obvious.

- 1.6.2 In the board's view, the superior efficacy and rapidity of the (unspecified) zinc carboxylate "ZnSoap" in the above-described first test reported on page 2 of D10 justifies the expectation of the skilled person reading this prior art, that the same "ZnSoap" might be the H₂S scavenger more likely to provide the best results also in the 50:50 oil:water mixture (in comparison to all other tested H₂S scavengers described in D10 to perform "well", and thus also in comparison to e.g. the oil soluble triazine, which undisputedly is a standard oil soluble H₂S scavenger).

Accordingly, D10 *per se* renders it obvious for the skilled person, aiming at an improved method for scavenging compositions containing oil and about 50 wt% water, to try the zinc carboxylate used in this prior art with a reasonable expectation of success.

- 1.6.3 Of course, given the absence of any further information in D10 as to the specific formula of "ZnSoap", the skilled person would turn to other prior art documents in the petrochemical field (to which also D10 belongs) dealing with the previous use of zinc carboxylate(s) as H₂S scavengers for oil-based systems.

The skilled person would then find in D5 an explicit pointer to several oil soluble zinc carboxylates, including zinc ethyl-hexanoate (i.e. a compound of zinc with a carboxylic acid with eight carbon atoms also mentioned on page 4, line 21 of the opposed patent, and thus also a zinc octoate in accordance with claim 1) as H₂S scavengers for, *inter alia*, hydrocarbon oils.

Reference is made to the fact that D5 discloses zinc as the most preferred cation (column 4, lines 41 to 44) and 2-ethylhexanoic acid as an anion (column 4, lines 17 and 18), which teaching is undisputed.

- 1.6.4 Hence a skilled person aiming at achieving improved scavenging of H₂S from the 50:50 oil:water mixture of D10, would consider at least obvious to try any of the zinc carboxylates disclosed in D5 as H₂S scavenger, in expectation that these compounds were the most likely to perform not only "well" (as acknowledged for "ZnSoap" in the second test on page 2 of D10), but even better than e.g. triazine and other H₂S scavenger well-performing in the 50:50 oil:water mixture.

Since the appellant did not even merely allege, let alone made plausible that zinc octoate is more effective as H₂S scavenger, or for any other reason surprisingly more advantageous than the other zinc carboxylates to which the disclosure of D10 appears applicable, it is apparent and undisputed that the selection of zinc octoate among the zinc carboxylates equally suggested as effective in D5, amounts to an arbitrary selection deprived of inventive merit.

Hence, the combination of the teachings of D10 with those of D5 renders it also obvious to expect that zinc octoate would provide in the 50:50 oil:water superior results, in comparison to other conventional H₂S scavengers (such as triazine) also tested in this prior art.

Therefore, the same combination of teachings renders it also obvious, as reasoned above, to solve the posed technical problem so as to arrive at the embodiments of the subject-matter of claim 1 in which the treated

mixed productions are only minimally different from the 50:50 oil:water mixture. Hence, the subject-matter of claim 1 of auxiliary request 2 is obvious for the skilled person in view of the teachings disclosed in D10 and D5.

1.7 It follows that auxiliary request 2 does not comply with the requirements of Article 56 EPC and cannot be allowed.

2. *Main request and auxiliary request 1*

The subject-matter of claim 1 of auxiliary request 2 is undisputedly fully encompassed by that of claim 1 of the main and first auxiliary request. Accordingly, (at least part of) the subject-matter of claim 1 of these requests is obvious in view of the prior art disclosed in D10 and D5 for substantially the same reasons given above for auxiliary request 2. Hence, also these requests do not comply with the requirements of Article 56 EPC and cannot be allowed.

3. *Auxiliary request 3 - Admittance and compliance with Articles 84, 123(2) and (3)*

3.1 The board notes that, since auxiliary request 3 - which corresponds to auxiliary request 2a filed at the oral proceedings in opposition and not admitted into the proceedings by the opposition division - has been filed with the grounds of appeal, it could only be excluded by the board using the discretion foreseen in Article 12(4) RPBA 2007 (Article 25(2) RPBA 2020).

3.2 The appellant stressed in this respect that in opposition the relevance of the experimental comparison reported in Example 1 of the patent - comparing the

efficacy of H₂S-scavengers in brine, namely in an aqueous system comprising no oil or hydrocarbon gas - had only been disputed in view of the fact that Example 1 did not compare an oil soluble H₂S-scavenger of the invention with the H₂S-scavengers used in D9, such as the water-soluble ethylene glycol hemiformal. Hence, the proprietor reacted to the preliminary opinion of the opposition division that D9 appeared to disclose the closest prior art by filing another experimental comparison (Annex A) similar to that in Example 1 of the patent (i.e. also using an aqueous system that comprised no oil), but in which the ethylene glycol hemiformal of D9 was used as comparative H₂S-scavenger.

During the oral proceedings it was thus confronted with the opposition division's unexpected conclusion that the effects proven by the data of Annex A would not suffice to demonstrate a technical advantage across the scope of claim 1 of the main request, because these data related to the treatment of an aqueous system comprising no substantial amount of oil and gas.

Confronted with such new objection, the proprietor attempted to submit a new request (AR 2A), which was however not admitted into the proceedings. Hence, to file again the same set of claims (as auxiliary request 3) with the grounds of appeal was its sole remaining possibility to react to the surprising conclusion of the opposition division as to the limited probative value of the data of Annex A.

- 3.3 These considerations, undisputed by the respondent, appear convincing to the board since in claim 1 of auxiliary request 3 the water content of the mixed production to be treated is required to be "greater than 90 wt%" (whereas in claim 1 of all preceding requests pending it is required to be "greater than 50

wt%"). Hence, the filing of a set of claims with this amendment is manifestly in reaction to the final finding of the opposition division that the data provided by the appellant in Annex A, relating to an aqueous system that comprised no oil, were insufficient. Thus the board concludes that the filing of auxiliary request 3 with the grounds of appeal was justified.

- 3.4 The respondent argued that the filing of said request aimed at limiting the claimed subject-matter over the prior art method disclosed in D10 (page 2, right column, second paragraph below figure 1) in which a 50:50 water:oil mixture is used, but since D10 was already cited in the notice of opposition, the appellant could and should have filed said request earlier, and thus it should be refused under the provisions of Article 12(4) RPBA 2007.
- 3.5 The board notes however that in the notice of opposition the respondent did not point specifically to the prior art method disclosed on page 2, right column, in which 50:50 water:oil mixture is treated, but to the left column on page 2 of D10, where the amount of water is not explicitly mentioned. Its submissions are thus insufficient at demonstrating that the appellant should have filed the present auxiliary request 3 well before the appeal.
- 3.6 The board is moreover satisfied that the claims of auxiliary request 3 do not raise issues under Articles 84, 123(2) and (3) EPC. No further reasons need to be given on these points, as the opposition division too found that this set of claims did not give rise to any objection under Article 123(2) EPC and the respondent did not submit any objections under these provisions.

3.7 Thus the board exercised its discretion under Article 12(4) RPBA 2007 (Article 25(2) RPBA 2020) to admit this request into the appeal proceedings.

4. Auxiliary request 3 - inventive step

4.1 The respondent's sole objection as to the compliance of claim 1 of said request with the requirements of the EPC was for lack of inventive step.

4.2 The board notes in this respect that it was common grounds among the parties that the prior art disclosed in D9 represents a suitable starting point for the assessment of inventive step. The board, considering the technical problem addressed in the patent in suit (see above) and noting that D9 discloses the use of certain H₂S-scavengers (manifestly polar compounds defined as "products derivable by the reaction of a carbonyl group-containing compound with an alcohol, thiol, amide, thioamide, urea or thiourea"; see claim 1 of D9) in particular for mixtures comprising oil, hydrocarbon gas and water (see in D9, claim 1 in combination with page 12, lines 3 to 18, in particular the final sentence reading "Preferably, the process is used to reduce the hydrogen sulphide level in a gas, for example a gas containing water and/or a liquid hydrocarbon", as well as the similar disclosure in claims 36 and 37), sees no reason to take a different stance.

4.3 The technical problem solved

Also for the subject-matter of claim 1 of this request the parties (each relying on their own experimental data and criticising the other's party data) arrived at

opposite conclusions as to the technical problem actually solved.

In particular, the respondent concluded that the technical problem addressed in the patent would not be solved by the subject-matter of claim 1 under consideration, which would thus just offer an obvious alternative to the prior art methods for scavenging H₂S from mixtures of oil, hydrocarbon gas and water.

4.3.1 The board found unnecessary to come to a conclusion as to (the relevance, meaning, sufficiency and/or admissibility of the apparently contradictory experimental data submitted by the parties and, thus, as to) which was the technical problem solved across the whole scope of claim 1 at stake, because the appellant rendered plausible that even if the technical problem solved was that identified by the respondent, still the claimed subject-matter would provide a solution that was not be obvious in view of the prior art.

4.3.2 Hence, in the following the board assumes, for the sake of an argument in favour of the respondent, that the technical problem solved is that identified by the respondent, namely to provide a further method for scavenging H₂S from mixtures of oil, hydrocarbon gas and greater than 90 wt% water.

4.4 The solution proposed and its non-obviousness

4.4.1 The solution offered in claim 1 at issue is to use zinc octoate as scavenger.

4.4.2 It is undisputed that the prior art of departure does not disclose any specific amount of water for the

mixture of oil, hydrocarbon gas and water considered in this prior art, so that the claimed method differs from the prior art of departure in that:

- the H₂S scavenger is zinc octoate, and
- the amount of water is greater than 90 wt%.

4.4.3 The respondent conceded that in D9 there was no reason to presume that the H₂S scavengers used could be used in mixtures comprising predominant amounts of water, let aside amounts of water near or above 90 wt%.

Nevertheless, it argued that a skilled person searching for a new method for removing some H₂S from a system containing hydrocarbon oils in such large amounts of water, would expect that the scavengers used in D9 as well as any of the other scavengers for hydrocarbon oils, including those previously found active in oil-based systems, would also be active when the water content is near or above 90 wt%. In its opinion, it was common general knowledge that any such scavenger for hydrocarbon oil should inevitably display some residual activity even in the presence of 90 wt% water or more. This expectation applied in particular to the (not further specified) zinc carboxylate scavenger disclosed in D10 to perform well even in a system containing 50 wt% water.

Alternatively, a skilled person would find in D5, which also discloses (a) oil soluble zinc octoate as scavenger for hydrocarbon oils, the explicit disclosure that another oil soluble zinc carboxylate (zinc neodecanoate) is active as scavenger even in a medium containing about 95 wt% water (see example 17 of D5).

Hence, the claimed subject-matter would be rendered obvious by the combination of D9 with D10 or D5.

4.4.4 In the board's view, this reasoning is based on a mere allegation, unsupported by any evidence and disputed by the appellant, as to the expectation of the skilled person that any compounds known as H₂S scavenger for hydrocarbon oils would inevitably also show some substantial activity also in systems with 90 wt% or more of water. In the board's view, it cannot be excluded that the activity of some known H₂S scavenger for hydrocarbon oil, and in particular the oil soluble ones disclosed in D5 or D10, might as well drop to zero upon increasing the water content of the treated system. Hence, a skilled person starting from D9 and aiming at solving the posed technical problem would only consider obvious to look for other H₂S scavengers for hydrocarbon oils that are already known to be active in essentially aqueous systems (i.e. in systems of water and hydrocarbons in which the amount of water is e.g. about 90 wt% or more).

4.4.5 However, in D10 the maximum amount of water described as possibly present in the system to be treated is 50 wt%, which is too low to justify any expectation that the oil soluble zinc carboxylate used in this prior art should be able to act as H₂S scavenger also in systems that are essentially aqueous, as the claimed system with an amount of water of 90 wt% or more.

Moreover, Example 17 of D5 could at most justify the expectation that the specific oil soluble zinc carboxylate used (i.e. zinc neodecanoate) could be active in a system with oil and around 95 wt% water. However, as finally admitted by respondent, in D5 there is no indication that also the zinc octoate mentioned therein, i.e. zinc ethylhexanoate, would be active in the specific medium used in Example 17 of D10, or in any other mixture of oil and greater than 90 wt% water.

Hence, neither D10 nor D5 discloses zinc octoate as a H₂S scavenger for oil that is plausibly active in essentially aqueous systems.

4.4.6 Finally, the board finds that the respondent's reasoning is based on an ex post facto analysis, because a skilled person starting from D9 and searching for a method suitable for treating systems comprising hydrocarbon oil and 90 wt% or more water would not have combined the prior art of departure with D5 or D10, for the following reasons:

- D9 presents certain polar products as H₂S scavengers for hydrocarbon oils, which allow to avoid or minimise the problems of calcium carbonate scale formation;
- neither D5 nor D10 present the advantages of oil-soluble H₂S scavengers, nor mention the scale formation problems;
- in particular the most preferred H₂S scavenger used in D9 (see the "ethylene glycol hemiformal" mentioned on page 23 of D9) is not only polar but even water soluble, and this document stresses the relevance of the scavengers' polarity (e.g. by stressing the advantages of using certain alcohols as solvents for the scavengers, see in D9 page 13, lines 16 to 17);
- whereas both D5 and D10 only stress the oil-solubility of zinc carboxylates (see e.g. the title of D5 and the abstract of D10).

It appears therefore that a skilled person, starting from the polar (and thus more prone to dissolve in water) H₂S scavengers described D9 and aiming at a method for scavenging essentially aqueous systems, could consider relevant the prior art relating to oil soluble H₂S scavengers disclosed in D5 or D10, only

with hindsight from the method of claim 1 under dispute.

- 4.5 Therefore, the objection of lack of inventive step (Article 56 EPC) of the subject-matter of claim 1 of auxiliary request 3 is found unconvincing. The same conclusion applies to dependent claims 2 and 3, which define preferred embodiments of the method of claim 1. Auxiliary request 3 thus complies with the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent in amended form based on the claims of auxiliary request 3 filed with the grounds of appeal (letter of 9 April 2019, and a description to be adapted where appropriate.

The Registrar:

The Chairman:



A. Pinna

J.-M. Schwaller

Decision electronically authenticated