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D E C I S I O N
of 18 August 2005

Case Number: T 0164/03 - 3.3.06

Application Number: 95942662.8

Publication Number: 0743972

IPC: C10L 1/14

Language of the proceedings: EN

Title of invention:
Fuel Oil Compositions

Patentee:
Infineum USA L.P.

Opponents:
Clariant Service GmbH
Ethyl Corporation
Associated Octel Comp. Ltd.
BASF AG

Headword:
Fuel Oil/INFINEUM

Relevant legal provisions:
EPC Art. 56, 123(2)

Keyword:
"Inventive step (main request, fourth and fifth auxiliary request (no): obvious combination of known Diesel additives of similar chemical structure"
"Admissibility of amendment (first to third auxiliary requests (no): different level of improvement; originally not disclosed (see point 3 of the reasons for the decision)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0164/03 - 3.3.06

D E C I S I O N
of the Technical Board of Appeal 3.3.06
of 18 August 2005

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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 4 December 2002 concerning maintenance of European patent No. 0743972 in amended form.**

Composition of the Board:

Chairman: P. Krasa
Members: G. Dischinger-Höppler
U. Tronser

Summary of Facts and Submissions

I. This appeal is from the interlocutory decision of the Opposition Division concerning maintenance of the European patent No. 0 743 972 in amended form on the basis of the then pending 5th auxiliary request (Set E'), the independent Claim 1 reading:

"1. The use of at least one nitrogen compound carrying one or more substituents of the formula > NR^{13}, wherein R^{13} represents a hydrocarbyl group containing 8 to 40 carbon atoms, the nitrogen compound

A1) being an amine salt and/or amide formed by reacting at least one molar proportion of a hydrocarbyl-substituted amine and a molar proportion of a hydrocarbyl acid having from 1 to 4 carboxylic acid groups or its anhydride, or

A2) containing a cyclic ring system carrying at least two substituents of the general formula

$$-A-NR^{15}R^{16}$$

on the ring system, where A is a linear or branched chain aliphatic hydrocarbyl group, and R^{15} and R^{16} are the same or different and each is independently a hydrocarbyl group containing 9 to 40 atoms,

to enhance the lubricity of a petroleum-based diesel fuel oil composition having a sulphur content of at most 0.05% by weight and also comprising a lubricity enhancer, wherein the lubricity enhancer is one or more

esters having a molecular weight of at most 950 and being of a polyhydric alcohol and a carboxylic acid."

II. Four notices of opposition had been filed against the granted patent, wherein the Opponents sought revocation of the patent on the grounds of, *inter alia*, Article 100(c) EPC for extension beyond the content of the application as filed (Article 123(2) EPC) and Article 100(a) EPC for lack of novelty and lack of inventive step (Articles 52(1), 54 (3) and 56 EPC). The oppositions were based, amongst others, on the following documents

D11 WO-A-94/17159, and

D12 WO-A-94/17160.

In an annex to a response to the summons for oral proceedings and in the course of the oral proceedings before the Opposition Division, respectively, the Opponents filed the following further documents:

D29 US-A-2 487 189 and

D30 WO-A-96/23855.

III. In its decision, the Opposition Division held that the subject-matter claimed in accordance with the fifth auxiliary request fulfilled the requirements of the EPC. The higher ranking requests were held to be not allowable for either lack of inventive step (main request, 3rd and 4th auxiliary requests) or lack of clarity (1st and 2nd auxiliary requests). Documents D29 and D30 filed late during opposition proceedings were

considered irrelevant and not admitted into the proceedings.

IV. This decision was appealed by the Patent Proprietor (hereinafter Appellant-Proprietor) and all Opponents (hereinafter Appellant-Opponents).

In the course of the appeal proceedings, the Appellant-Opponents filed amongst others the following further documents

D36 H.A. Spikes et al., "Development of a Laboratory Test to Predict Lubricity Properties of Diesel Fuels and its Application to the Development of Highly Refined Diesel Fuels" in Technische Akademie Esslingen, 9. Internationales Kolloquium, 11. - 13. Januar 1994, pages 3.11-1 to 3.11-16,

D49 ISO/TC22/SC7 N188, Diesel Engines - Diesel Fuel - Performance Requirement and Test Method for Assessing Fuel Lubricity,

D50 Keith Owen, Trevor Coley; Automotive Fuels Handbook, 1990, Society of Automotive Engineers, Inc., Warrendale PA, pages 299, 300, 353 to 403, 417, 421, 445 and 535.

The Appellant-Proprietor filed under cover of a letter dated 15 July 2005 four amended sets of claims in a new main request (set I') and three auxiliary requests (sets I'', I-1' and I-1'').

V. Upon requests made by all parties, oral proceedings before the Board of Appeal were held on 17 and 18 August 2005 in the course of which the Appellant-Proprietor again filed three sets of amended claims in a new main request (Set I'-A) and in a fourth and fifth auxiliary request (Set K and Set L).

Claim 1 of the main request (Set I'-A) differs from that considered allowable by the Opposition Division (Set E', see point I above) in that the term "aliphatic hydrocarbyl group" has been replaced by "aliphatic hydrocarbylene group".

Claim 1 of the first auxiliary request (Set I'') differs from that of the main request in that the term ", as measured by the HFRR test at 60°C," has been inserted after the term "to enhance the lubricity".

Claim 1 of the second auxiliary request (Set I-1') reads as follows (the amendments with respect to Claim 1 of the main request have been highlighted by the Board)

"1. The use of at least one nitrogen compound carrying one or more substituents of the formula > NR^{13}, wherein R^{13} represents a hydrocarbyl group containing 8 to 40 carbon atoms, the nitrogen compound

A1) being an amine salt and/or amide formed by reacting at least one molar proportion of a hydrocarbyl-substituted **secondary** amine and a molar proportion of a hydrocarbyl acid having from 1 to 4 carboxylic acid groups or its anhydride, **wherein the substituent(s) of the formula >NR^{13} are**

of the formula -$NR^{13}R^{14}$ wherein R^{13} is as defined above, R^{14} represents hydrogen or R^{13}, provided that R^{13} and R^{14} may be the same or different, said substituents constituting part of the amine salt and/or amide groups of the nitrogen compound, or

A2) containing a cyclic ring system carrying at least two substituents of the general formula

$$-A-NR^{15}R^{16}$$

on the ring system, where A is a linear or branched chain aliphatic hydrocarbylene group, and R^{15} and R^{16} are the same or different and each is independently a hydrocarbyl group containing 9 to 40 carbon atoms,

to enhance the lubricity**, as measured by the HFRR test at 60°C,** of a petroleum-based diesel fuel oil composition having a sulphur content of at most 0.05% by weight and also comprising a lubricity enhancer, wherein the lubricity enhancer is one or more esters having a molecular weight of at most 950 and being of a polyhydric alcohol and a carboxylic acid, **wherein the or each nitrogen compound is employed in a proportion within the range of from 0.005% to 1% by weight, based on the weight of the fuel oil, and the lubricity enhancer is employed in a proportion within the range of from 0.0001% to 0.3% by weight, based on the weight of the fuel oil.**"

Claim 1 of the third auxiliary request (Set I-1'') differs from that of the second auxiliary request in that the term "carrying one" has been replaced by

"carrying two" and in that the term "substituent(s)" has been replaced by "substituents".

Claim 1 of the fourth auxiliary request (Set K) differs from that of the main request in that the term "secondary" has been introduced between "hydrocarbyl-substituted" and "amine".

Claim 1 of the fifth auxiliary request (Set L) differs from that of the main request in that the term "wherein the substituent(s) of the formula $>NR^{13}$ are of the formula $-NR^{13}R^{14}$ wherein R^{13} is as defined above, R^{14} represents R^{13}, provided that R^{13} and R^{14} may be the same or different, said substituents constituting part of the amine salt and/or amide groups of the nitrogen compound," has been introduced between "anhydride," and "or".

VI. The Appellant-Opponents, orally and in writing, submitted in essence the following arguments:

- The amendments made to the claims were not allowable since they introduced non-clarity and subject-matter which extended beyond both, the content of the application as filed and the protection conferred by the patent. In particular, the feature "as measured by the HFRR test at 60°C" introduced into Claim 1 of the first to third auxiliary requests was not originally disclosed in combination with the other features of these claims. In this respect, reference was also made to D49.

– The claimed subject-matter was not entitled to enjoy the claimed priorities and anticipated by D30 which was prior art under Article 54(3) EPC.

– The subject-matter claimed in the main request was not inventive over D12 as the closest prior art.

The technical problem to be solved in view of D12 by the claimed addition of a particular nitrogen compound consisted in a further improvement of the lubricity of the fuel oil. However, the same nitrogen compound was used according to D29 as lubricity enhancer in petroleum-based diesel fuel oil having a sulphur content of 0.05% by weight (hereinafter "light diesel fuel") and known, from e.g. D11, as cold flow improver for diesel oil. Since the chemical structures of the ester and the nitrogen compounds were similar and since the using of multifunctional additive packages was conventional in the art, it was obvious for those skilled in the art to use these compounds in combination under the aspect of economy and in order to improve the lubricity where the ester alone was not sufficient.

– The subject-matter of Claim 1 of the fourth and fifth auxiliary requests was not inventive for the same reason. Although it differed from Claim 1 of the main request in that the amine salt and/or amide was necessarily derived from a secondary amine, the chemical structure of this compound was still very similar to and of the same kind as that of the esters lubricants. In view of D29 and the known utility of these compounds as cold-flow

improvers, it was obvious to also try these compounds for the purpose of enhancing the lubricity of light diesel oil.

VII. The Appellant-Proprietor requested not to admit any of the Appellant-Opponents' late filed evidence including D29 and D30. It submitted in essence the following arguments:

– The amendments made to the claims met the requirements of Articles 84 and 123 EPC.

– Notwithstanding the entitlement to the claimed priorities, the claimed subject-matter was novel over D30.

– In view of D12 as the closest prior art, the claimed subject-matter was inventive for the following reasons:

The technical problem to be solved in view of D12 consisted in the finding of a technical measure for further improving lubricity of light diesel oil comprising a given amount of ester lubricant. In the examples of the patent in suit it was shown that this problem had actually been solved by the claimed use of a particular nitrogen compound.

The effect provided by the claimed use on the lubricity of light diesel fuel containing a particular ester compound as lubricity enhancer was a feature of the claim and, therefore, valid over the whole scope of the claim.

The effect could not have been foreseen by the skilled person or expected in the light of the cited prior art since D12 did not mention nitrogen compounds as possible co-additives in diesel fuel and D29, published some 45 years before the priority date of the patent in suit, disclosed the use of a mixture of different compounds for a variety of purposes, including reduction of corrosive wear but not enhancing lubricity.

Hence, there was no reason for a skilled person to identify within the mixture of components disclosed in D29 the amine salts as capable for enhancing the lubricity of modern diesel fuel, the more so as a variety of other materials of different chemical constitution was known for this purpose.

According to D36, it was counterintuitive to combine corrosion inhibitors with lubricants and, given the fact that lateral Van der Waals interactions between the molecules adsorbed on the metal surfaces were important for the stability of the lubricating layer, no improvement could be expected from the combination of chemical compounds of different structure.

Since further cold flow additives were active in the bulk of the fuel whereas lubricity agents take effect on the interface between fuel and metal surface, a skilled person would not consider the former for lubrication. This was confirmed by D50, according to which it was well established in the art that cold flow additives have no other

influence on the fuel than improving its low-temperature properties.

In particular it was not obvious from D29 relating to nitrogen containing additives derived from primary amines having one hydrocarbon chain to use for lubrication nitrogen compounds which were derived from secondary amines having two hydrocarbon chains since a skilled person would have assumed a different steric orientation of those hydrocarbon chains at the metal surface.

VIII. The Appellant-Proprietor requested that the decision under appeal be set aside and that the patent be maintained on the basis of

Claims 1 to 13 of Set I'-A (main request) as submitted during oral proceedings or

Claims 1 to 14 of Set I'',

Claims 1 to 12 of Set I-1' or

Claims 1 to 12 of Set I-1'' respectively submitted under cover of the letter dated 15 July 2005 and a description adapted to the three auxiliary requests respectively, or

Claims 1 to 12 of Set K as submitted during oral proceedings or

Claims 1 to 12 of Set L as submitted during oral proceedings.

The Appellant-Opponents requested that the decision under appeal be set aside and the patent be revoked.

Reasons for the Decision

1. *Late filed evidence*

Pursuant to Article 114(2) EPC, the Boards of Appeal may admit into the proceedings evidence filed late in proceedings either before the Opposition Division or the Boards in those cases where such new material is highly relevant in the sense that it can reasonably be expected to change the eventual result of the proceedings and is thus highly likely to prejudice maintenance of the European patent (Case Law of the Boards of Appeal of the European Patent Office, 4th edition 2001, VI.F.2. and VI.F.3.).

1.1 D29 was filed by Opponent I about four weeks before oral proceedings took place before the Opposition Division, and re-filed with Opponent I's notice of appeal. The Opposition Division decided not to admit this document into the proceedings for being not relevant for their decision. No reasons were given for that finding.

As will be evident from the reasoning set out below in relation with the issue of inventive step of the claimed subject-matter (main request, fourth and fifth auxiliary requests), the Board does not share the Opposition Division's view and thus admits D29 into the proceedings because of its relevance.

1.2 D36, D49 and D50 were all filed in the course of the Appeal proceedings in support of the existence of common general knowledge. Such existence has not been challenged by the Appellant-Proprietor, who even argued on the basis of these documents in writing and during oral proceedings. The Board, therefore, admits these documents into the proceedings for the purpose they were filed.

2. *Main request*

2.1 The Board is convinced that the amendments made to the claims do not violate the provisions of Articles 84 and 123(2) and (3) EPC. Since the Appellant-Proprietor's main request fails for the reasons set out below, no further details need to be given.

For the same reason it is not necessary in the present case to consider the issues of whether the patent in suit enjoys the priorities claimed, whether late filed D30 should be admitted into the proceedings and whether the claimed subject-matter is novel over the disclosure of that document which is state of the art according to Article 54(3) EPC.

2.2 Inventive Step

2.2.1 The patent in suit and in particular Claim 1 relate to the use of selected compounds for improving the lubricity of light diesel fuel, i.e. diesel fuel having a sulphur content of at most 0.05% by weight (page 2, paragraph [0001] in combination with page 3, paragraph [0014]).

As is explained in the description of the patent in suit, environmental concerns have led to the need for light diesel fuels. These show, however, in particular because of the reduced amounts of polar and aromatic polycyclic compounds due to the refining processes, a worse lubricity which causes an increased wear and failure in the fuel pumps (page 2, paragraphs [0002] to [0004]).

D12 also deals with the improvement of lubricity of light diesel fuels. It identifies the same technical problem and its origin, namely excessive wear and pump failure of diesel engines due to the reduced content of sulphur, polyaromatic and polar compounds after refining (page 1, lines 3 to 36).

The Board agrees, therefore, with the parties that D12 is a suitable starting point for the assessment of inventive step.

2.2.2 According to D12, the above mentioned technical problem of excessive wear of diesel engines has already been solved by using as lubricity enhancers the same esters as defined in the patent in suit. Those esters were able to bring the HFFR wear scar diameter as measured at 60°C down to a value of at most 500 µm as required in the patent in suit (see in D12, tables on page 10; in the patent, paragraphs [0010], [0012], [0014] and [0015] in combination with Table 2).

2.2.3 According to the patent in suit, it has been found that the nitrogen compounds used in accordance with Claim 1 were able to enhance the lubricity of light fuel oils containing a conventional lubricity enhancer in the

sense that either a higher level of lubricity is obtained for a fixed amount of conventional lubricity enhancer or that an equivalent level of lubricity is obtained at a lower amount of conventional lubricity enhancer (paragraph [0009]).

In view of D12, so the Appellant-Proprietor argued, the technical problem to be solved can, therefore, be defined to consist in further improving the lubricity of light diesel fuel comprising a given amount of ester lubricant.

2.2.4 The Appellant-Proprietor indicated that it was apparent from the experimental data in the patent in suit that this problem had actually been solved by the claimed subject-matter.

2.2.5 The Board agrees with the Appellant-Proprietor insofar as the experiments in the patent in suit (see Table 2) show that the application of a nitrogen compound produced by reacting one mole of phthalic anhydride with two moles of di(hydrogenated tallow)amine, i.e. a N,N-dialkylammonium salt of 2-N',N'-dialkylamido-benzoate, in amounts of 67 ppm or 167 ppm respectively, brings the HFFR wear scar diameter (measured at 60°C) from 656 µm of the untreated sample down to 572 µm or 507 µm respectively, whereas an ester obtained by esterifying dilinoleic acid with ethylene glycol and neutralizing free acid groups methanol applied in amounts of 120 ppm or 150 ppm respectively, hardly changes the wear scar diameter at all, considering the error margin derivable from Table 2 of the patent in suit (wear scar between 615 and 661 µm for 120 ppm ester applied) or the standard deviation for the HFFR test

given in D36 of around ± 10 µm (D36, page 3.11-4, left-hand column, last full paragraph). However, if the nitrogen compound and the ester are applied in these amounts in combination, an improvement in the fuel's lubricity is obtained, even in comparison with the application of the nitrogen or ester compound alone in amounts comparable or higher than the total amount used in the combination. It is further shown that both, the nitrogen and ester compound are able to improve the lubricity considerably (down to a wear scar diameter of 400 µm) if applied in higher amounts (334 ppm or 360 ppm respectively).

According to the patent in suit, the lubricity enhancer is advantageously employed in a proportion of 0.0001% to 10% by weight (see paragraph [0050]). Since the subject-matter of Claim 1 is not restricted in this respect, it covers embodiments wherein the ester lubricant is present in an amount of only 1 ppm or less.

The Board is, therefore, satisfied that the experiments show credibly that the above technical problem is solved in those instances where the ester compound alone is applied in an amount insufficient to improve the fuel's lubricity.

2.2.6 It remains to be decided whether, in view of the available prior art documents, it was obvious for someone skilled in the art to solve the above stated technical problem of further improving the lubricity of light diesel fuel comprising a given but insufficient amount of ester lubricant by the means claimed, namely

by adding at least one of the nitrogen compounds specified in Claim 1.

2.2.7 D12 does not mention nitrogen compounds but indicates several classes of co-additives to be used in combination with the ester lubricants, *inter alia*, cold flow improvers (page 7, lines 16 to 23). D11 relates specifically to cold-flow improvers for fuel oils (page 1, lines 7 to 15) and proposes for this purpose, amongst others, the same polar nitrogen compounds specified in Claim 1 of the patent in suit (page 12, lines 21 to 29 and page 16, line 12 to page 20, line 13). It is mentioned in D11 that other additives, e.g. lubricity additives, may also be added (page 24, lines 19 to 21) but there is no indication in either of these documents that the cold-flow additives of D11 might be useful for lubrication.

2.2.8 However, D29 discloses an additive for Diesel fuel, in particular light Diesel fuel, for improving the performance of Diesel engines, which additive is composed of the aliphatic amine salt made from a long chain primary aliphatic amine having at least 10 carbon atoms and the mixture of fatty acids obtained by hydrolysing sperm oil, and the mixture of aliphatic alcohols obtained by hydrolysing sperm oil (column 1, lines 1 to 5 and 32, column 2, lines 3 to 16 and column 3, line 52).

It is undisputed that sperm oil consists of 75% of esters of lauric-, oleic, myristic and palmitic acid with cetyl-, oleic and stearic alcohol and 25% of glycerides of the above fatty acids. Hence, the above

product consists largely of an amine salt in accordance with claim 1.

It is said in D29 that Diesel fuels containing the additive in an amount of at least 0.01 % by weight, i.e. 100 ppm, substantially prevents corrosion, wear and gum formation on the high pressure injection pumps, interior cylinder surfaces and piston rings (column 1, lines 40 to 45 and column 4, lines 12 to 16).

2.2.9 The Appellant-Proprietor essentially argued that the solution of the existing technical problem proposed in the patent in suit had never been recognised before in the prior art. The claimed subject-matter was, therefore, not obvious, both, prima facie and from the prior art on file.

In particular, the Appellant-Proprietor submitted that the additive disclosed in D29 was a mixture of amine salts, alcohols and glycerides proposed for the purposes of preventing corrosion and gum formation, but not lubricity. The purpose of prevention of wear referred to in D29 related to wear resulting from corrosion. This was apparent from the fact that whenever wear was mentioned in D29, the mentioning was in connection with corrosion. Therefore, D29 did not disclose that the amine salts were suitable for lubrication.

Hence, so the Appellant-Proprietor contended, the additive mixture of D29 was disclosed as corrosion inhibitor. However, it was known from D36 that corrosion inhibitors should not be used in Diesel fuel because of unacceptable interactions with the lubricant

present in the in-line fuel distribution pumps (page 3.11-2, left-hand column, last but one paragraph).

Moreover, D29 was an old document, published in 1949, which a skilled person looking for a solution of a problem with the lubrication properties of Diesel fuel developed in the nineties would not consider. If anything, he would rather consider the conventional lubrication agents like those referred to in the patent in suit (page 2, lines 26 to 31).

Further, a skilled person would not have combined different additives of different structure since it was well-known in the art that the stability of the lubricating layer was dependent on the lateral interactions between the adsorbed molecules.

Nor was there any reason for a skilled person to consider cold-flow additives to be suitable for lubrication since, on the one hand, it was known in the art, e.g. from D50 (page 368, first full paragraph), that cold flow additives have no influence on the fuel other than its low-temperature properties and, on the other hand, it was apparent that a different reaction mechanism applied for cold flow additives which were effective in the bulk of the fuel whereas lubricants were active on the interface between fuel and metal surface.

2.2.10 The Board is not convinced by these arguments for the following reasons:

It is true that D29 refers to a variety of different technical problems with Diesel fuels. One such problem is the formation of varnish or gum on the engine parts (column 1, lines 49 to 51). Another problem is corrosion of the engine parts if water is present (column 1, lines 51 to 54). Still another problem is seen in the wear on the engine parts (column 1, line 54 to column2, line 1). It may be true, as assumed by the Appellant-Proprietor, that D29 implicitly addresses in addition the problem of corrosive wear. However, D29 explicitly mentions also the problem of insufficient lubricity of light Diesel fuel (column 1, lines 34 to 40) and reports in this respect that with certain light fuel oils the wear on the injectors and plungers is sufficient to render them inaccurate after a few days operation (column 1, lines 31 to 34), a period of time which is typically due to insufficient lubrication (see patent in suit, page 2, lines 8 to 12) as compared to corrosive wear occurring later in the life of an engine (see D12, page 1, line 28 to page 2, line 5). The Board concludes, therefore, that a skilled person would learn from D29 that the additives disclosed therein are suitable to reduce wear originating from insufficient lubrication or, in other words, that the additives are suitable for lubrication.

It is also true that the additive of D29 contains a mixture of components in as much as it is mentioned that, apart from the amine salts, also the aliphatic alcohols obtained by the hydrolysation of the sperm oil are present (column 2, lines 3 to 16 and claims). The

Board notes that, nevertheless, the amine salts are explicitly emphasized as useful for the purposes of D29 (column 2, lines 17 to 50 and column 3, lines 26 to 29). Hence, a person skilled in the art would identify the amine salt as the active ingredient of the additive.

Concerning the warning in D36 not to use corrosion inhibitors and lubricants together, the Board notes that this statement relates to specific but not identified anti-corrosion additives used in aviation kerosene. It is, therefore, not in contradiction with the disclosure in D11 and D12 according to which no prejudice exists against the combination of corrosion inhibitors and lubricants in Diesel fuel (D11, page 24, lines 19 to 21; D12, page 7, lines 18 to 23) and no reason for a skilled person not to use the additives of D29 together with the lubricants of D12.

Even though D29 was published about 45 years before the priority date of the patent in suit, it already related to light Diesel fuel having a sulphur content of 0.05% and the implication of insufficient lubrication (column 1, lines 31 to 40 and column 3, line 52). Further, it appears from D15 that low sulphur content in Diesel fuel was not an issue for the suppliers before the governmental restriction due to environmental concerns took effect in Sweden and Japan in 1992, followed by the United states in 1993 (page 1, right-hand column, first and second full paragraphs). Given these circumstances, the skilled person had good reasons to consider the old technology of D29 at the priority date of the patent in suit in 1994, even though it did not play any role in the meantime.

The Board agrees with the parties that according to the current understanding of the theory generally accepted in the art, a lubricating layer is composed of molecules having a polar head group and an non-polar hydrocarbon chain of some length and that the molecules are arranged in the layer so that the polar heads are attached to the metal surface and the hydrocarbon chains are oriented approximately normal to the metal surface, comparable to the pile of a carpet. It is also plausible that lateral Van der Waals interaction stabilises the lubricating layer. Such lateral interaction undisputedly takes place between the hydrocarbon chains. Therefore, the Board agrees with the Appellant-Opponents that a skilled person would consider, prima facie, any compound consisting of a polar head and non-polar hydrocarbon chain as suitable for combination with the esters disclosed in D12 due to the similarity of the chemical structure in this respect.

The Appellant-Proprietor's reference to D50 in regard to the properties of cold-flow additives is not acceptable if only for the reason that the quotation addresses specific copolymers of ethylene and vinyl acetate or other olefin-ester copolymers which are different from those used in D12 and the patent in suit.

Likewise, the Board cannot accept the argument that cold flow additives had other properties than lubricants due to a different place (bulk liquid or metal/liquid interface) of reaction within the fuel/engine system. Apart from the fact that this

argument was not supported by evidence, it is in the Board's view common general knowledge that a chemical compound acts as a cold flow additive if it prevents wax crystals from growing and settling (see e.g. D50, page 372 and D11, page 1, lines 10 to 15). Hence, a cold flow additive acts at an interface between solid (wax) and fuel as does a lubricant. The only difference, the Board can see is, that in the case of lubricant, it is the polar head which attaches to a metal surface whereas in the case of a cold flow additive, it is the non-polar hydrocarbon chain which attaches to a wax surface.

2.2.11 The Board is, therefore, of the opinion that D29 proposes amine salts in accordance with Claim 1 for improving, inter alia, the lubricity of light Diesel fuel and concludes that it was, thus, obvious for those skilled in the art to use this compound - just as any other compound known for this purpose - in the reasonable expectation to improve the lubricity of light Diesel fuel which comprises an ester lubricant of the kind disclosed in D12 in insufficient amounts. Moreover, the skilled person had good reasons to prefer the amine salt to any other lubricity enhancer in view of its structural similarity with the ester lubricants and since it is known to be suitable for multiple purposes, namely also as corrosion inhibitor and to prevent gum formation as disclosed in D29 and as cold flow improver as disclosed in D11.

The skilled person would thus arrive in an obvious manner at the claimed subject-matter.

2.3 For these reasons the Board finds that the subject-matter of Claim 1 is not based on an inventive step and does not comply with the requirements of Articles 52(1) and 56 EPC.

3. *First to third auxiliary requests*

In Claim 1 of these requests the feature "to enhance the lubricity" has been specified by the feature "as measured by the HFFR test at 60°C".

In the Appellant-Proprietor's view this amendment was based on the following disclosure of the application as filed:

- page 5 where the HFFR test was mentioned;

- page 3 where it was indicated that the compositions resulting from the use according to the fourth aspect (of the invention) preferably have a lubricity in as defined in relation to the second and third aspects (lines 29 to 31), hence a lubricity as measured by the HFFR test at 60°C (lines 7 to 8 and 19 to 20); and

- page 17 where it was shown that the HFFR test was employed at 60°C in the examples (lines 4 to 5).

The Board notes that according to the original disclosure (page 5, lines 21 to 30) the enhancement of lubricity may be measured by any test suitable therefore. Particularly mentioned are the HFFR test and the BOCLE test. No reference to the temperature to be used for measuring is indicated in this paragraph.

However, it is known in the art that the HFFR test is normally carried out at particular temperatures, namely 60°C and 25°C (D49, page 1, right-hand column, last paragraph) or 70°C (D15, page 13, left-hand column, first full paragraph) giving different values of lubricity according to the temperature used.

In the application as filed a temperature, namely 60°C, is only mentioned in the references cited by the Appellant-Proprietor with regard to the second and third aspect of the invention and in the examples. The second and third aspects of the invention both relate to a process for the manufacture of a composition having "a lubricity such as to give a wear scar diameter, as measured by the HFFR test at 60°C of at most 500 µm". The same applies to the examples where the wear scar diameter of the samples in accordance with the claimed subject-matter (Table 2, last three lines) is below 500 µm when measured according to the HFFR test at 60°C.

Hence, the combination of the HFFR test with the temperature of 60°C to be applied is originally disclosed only in relation with a particular result (wear scar diameter of at most 500 µm), i.e. a particular improvement of the lubricity.

Since Claim 1 of the first to third auxiliary requests is not restricted in this respect, it covers wear scar diameters of more than 500 µm when measured by the HFFR test at 60°C and hence a different level of improvement at that temperature which is originally not disclosed.

The Board concludes, therefore, that the amendments made to Claim 1 of the first to third auxiliary request introduce subject-matter which extends beyond the content of the application as filed contrary to the requirements of Article 123(2) EPC.

4. *Fourth auxiliary requests*

4.1 Claim 1 differs from that of the main request only in that the amine salt and/or amide defined under A1) is necessarily derived from a secondary amine.

This amendment is admissible under Articles 84 and 123(2) and (3) EPC. Since the request fails for lack of inventive step, no further reasons need to be given here. The same applies to the question of novelty (see above 2.1).

4.2 No other effect is achieved with the claimed subject-matter than that referred to above under 2.2.5. Therefore, the technical problem solved in view of D12 remains the same (see 2.2.5 last paragraph) too.

This was not contested by the Appellant-Proprietor who conceded that the now defined nitrogen compounds also consisted of a polar head group but, as compared with the amine salts of D29, two non-polar hydrocarbon chains instead of one.

However, so the Appellant-Proprietor argued, these compounds were known for improving the cold flow properties of Diesel fuels but neither disclosed nor hinted at for lubrication. It based its arguments on the allegation that the effect of this particular

component as cold flow improver was due to the fact that one hydrocarbon group was attached to the wax surface while the other one was oriented away from the wax crystal, thereby putting a stop to further crystal growth. Therefore, it was not conceivable for those skilled in the art that such a compound could provide a lubricating layer on a metal surface since the molecules would be oriented in such a manner that the hydrocarbon chains were spaced apart from each other, thus preventing the lateral interaction necessary for stabilizing the layer.

In spite of being true that the prior art on file does not suggest nitrogen compounds derived from secondary amines for lubrication, the Appellant-Proprietor's argument cannot succeed since it is based on an allegation in respect of the reaction mechanism between the nitrogen compound and the wax or metal surface for which no evidence has been provided. Moreover, lubricating agents having more than one hydrocarbon chains are known in the art, e.g. from D12, which includes esters of polyhydric alcohols, such as glycol or glycerol, where all of the hydroxy groups are esterified (page 5, lines 11 to 12 and 27 to 28) and are not excluded in the patent in suit (page 5, paragraphs [0038], [0040] and [0044]).

The Board agrees therefore with the Appellant-Opponents that the nitrogen compound derived from a secondary amine used in accordance with Claim 1 fulfils the known structural requirements for lubricants (see above point 2.2.10, 3rd paragraph) and has still a structure similar to that of the ester lubricants used in D12 and the patent in suit.

In the light of D29, disclosing as lubricity enhancer for light Diesel fuel amine salts derived from primary amines having a structure similar to that of the ester lubricants disclosed in D12, and considering further that the compounds derived from secondary amines are also structurally similar with ester lubricants according to D12 and are known for use in Diesel fuels (D11), the Board concludes that the skilled person would have tried these amine salts derived from secondary amines in light Diesel fuel containing an ester lubricant and expected that they also enhance the lubricity if the ester lubricant is contained in an insufficient amount.

Therefore, the subject-matter of the fourth auxiliary request does not amount to an inventive step (Articles 52(1) and 56 EPC).

5. *Fifth auxiliary request*

The same arguments put forward above apply *mutatis mutandis* to Claim 1 of this request since, as conceded by the Appellant-Proprietor, it only expresses in other words the subject-matter of Claim 1 of the fourth auxiliary request, but is otherwise identical with in its technical content.

The fifth auxiliary request has thus to be dismissed for the same reasons.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

G. Rauh P. Krasa