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D E C I S I O N
of 9 May 2000

Case Number: T 0448/97 - 3.2.2

Application Number: 89810679.4

Publication Number: 0360745

IPC: C23F 11/173

Language of the proceedings: EN

Title of invention:
Treatment of aqueous systems

Patentee:
FMC CORPORATION (UK) LIMITED

Opponent:
BASF Aktiengesellschaft Patente, Marken und Lizenzen

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0448/97 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 9 May 2000

Appellant: (Proprietor of the patent)
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Representative:
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Respondent: (Opponent)
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D-67056 Ludwigshafen (DE)

Representative:
-

Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 20 February 1997 revoking European patent No. 0 360 745 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: W. D. Weiß
Members: R. Ries
J. C. M. De Preter

Summary of Facts and Submissions

I. On 21 April 1997, the proprietor of the patent lodged an appeal against the decision of the opposition division posted on 20 February 1997 to revoke the European patent No. 0 360 745. The appeal fee was paid the same day. The statement of grounds for appeal was received on 20 June 1997.

II. The patent was opposed on the grounds of lack of novelty and inventive step (Article 100(a) EPC).

The opposition division held that the claimed subject matter of the main request and of the auxiliary request did not involve an inventive step and, therefore, revoked the patent.

III. In the opposition procedure and the appeal procedure, the discussion was based on the following documents:

D1: JP-A-61-87714 and

D1': translation of D1 into English

D2: US-A-4 126 549

IV. In its response to an official communication from the Board, the appellant (patentee) submitted a copy of document

D3: JP-B-J71019437 including an abstract in English.

V. Oral proceedings were held on 9 May 2000, at the end of which the request of the parties were as follows:

The appellant (patentee) requested that:

- the decision under appeal be set aside and the patent be maintained as granted as the main request, or

- the patent be maintained in amended form on the basis of one of the two auxiliary requests submitted at the oral proceedings.

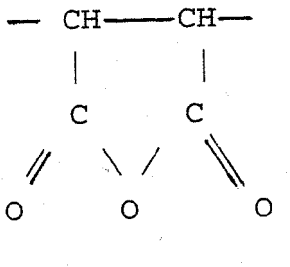
The respondent (opponent) requested that the appeal be dismissed.

VI. Claim 1 according to the main request reads as follows:

"1. A method of treating an aqueous system comprising adding to the system a water-soluble tri-copolymer having the formula I:

$(A)_x(B)_y(C)_z$ I

or a salt thereof, wherein A is a group having the formula:



or a hydrolysed (dicarboxylic acid or salt) form of this group;

B is a group having the formula:

$-CH_2-C(R_1)CO_2R_2)-$

wherein R_1 is hydrogen or methyl, and R_2 is hydrogen or C_1-C_8 straight- or branched chain alkyl or R_2 is C_1-C_8 straight- or branched chain alkyl substituted by a group $-OR_3$ wherein R_3 is hydrogen or a group of formula $-[CH_2CH(R_4)O]_nH$ wherein R_4 is hydrogen or methyl and n is an integer from 1 to 10;

C is a group having the formula:

$-CH(R_5)-C(R_6)(R_7)-$

wherein R_5 is hydrogen, phenyl or C_1-C_{18} straight- or branched chain alkyl, preferably hydrogen and R_6 and R_7, independently, are hydrogen, C_1-C_{18} straight- or branched chain alkyl, phenyl or substituted phenyl, and

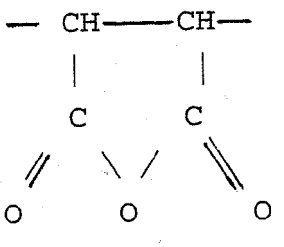
x, y and z are integers, so chosen that 1) the molar ratio of A in the tri-copolymer ranges from 30 to 80 % by weight; the molar ratio of B in the tri-copolymer ranges from 10 to 40 % by weight; and the molecular ratio of C ranges from 10 to 30 % by weight; and 2) the molar weight of the tri-copolymer is within the range of from 600 to 10,000."

Claim 1 of the first auxiliary request reads as follows:

"1. A method of treating an aqueous system comprising adding to the system a water-soluble tri-copolymer having the formula I:

$(A)_x(B)_y(C)_z$ I

or a salt thereof, wherein A is a group having the formula:



or a hydrolysed (dicarboxylic acid or salt) form of this group;

B is a group having the formula:

$-CH_2-C(R_1)CO_2R_2)-$

wherein R_1 is hydrogen or methyl, and R_2 is hydrogen or C_1-C_8 straight- or branched chain alkyl or R_2 is C_1-C_8 straight- or branched chain alkyl substituted by a group $-OR_3$ wherein R_3 is hydrogen or a group of formula $-[CH_2CH(R_4)O]_nH$ wherein R_4 is hydrogen or methyl and n is an integer from 1 to 10;

C is a group having the formula:

$-CH(R_5)-C(R_6)(R_7)-$

wherein R_5 and R_6 are hydrogen and R_7 is C_6-C_{12} straight- or branched chain alkyl, phenyl or substituted phenyl, and

x, y and z are integers, so chosen that 1) the molar ratio of A in the tri-copolymer ranges from 30 to 80 % by weight; the molar ratio of B in the tri-copolymer

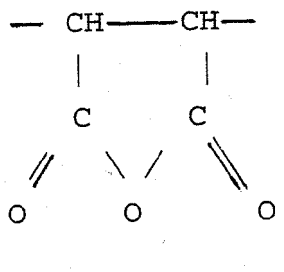
ranges from 10 to 40 % by weight; and the molecular ratio of C ranges from 10 to 30 % by weight; and 2) the molar weight of the tri-copolymer is within the range of from 600 to 10,000."

Claim 1 of the second auxiliary request reads as follows:

"1. A method of treating an aqueous system comprising adding to the system a water-soluble tri-copolymer having the formula I:

$(A)_x(B)_y(C)_z$ I

or a salt thereof, wherein A is a group having the formula:



or a hydrolysed (dicarboxylic acid or salt) form of this group;

B is a group having the formula:

$-CH_2-C(R_1)CO_2R_2)-$

wherein R_1 is hydrogen or methyl, and R_2 is hydrogen or C_1-C_8 straight- or branched chain alkyl or R_2 is C_1-C_8 straight- or branched chain alkyl substituted by a group $-OR_3$ wherein R_3 is hydrogen or a group of formula $-[CH_2CH(R_4)O]_nH$ wherein R_4 is hydrogen or methyl and n is

an integer from 1 to 10;

C is a group having the formula:

$-CH(R_5)-C(R_6)(R_7)-$

wherein R_5 and R_6 are hydrogen and R_7 is phenyl, and

x, y and z are integers, so chosen that 1) the molar ratio of A in the tri-copolymer ranges from 30 to 80 % by weight; the molar ratio of B in the tri-copolymer ranges from 10 to 40 % by weight; and the molecular ratio of C ranges from 10 to 30 % by weight; and 2) the molar weight of the tri-copolymer is within the range of from 600 to 10,000."

VII. The appellant argued essentially as follows:

The whole teaching of document D1 is concerned with a process for producing a (maleic acid anhydride- methyl methacrylate - isobutylene) ternary copolymer rather than the particular use of the product. Despite a certain overlap in the ranges of the molecular weight, none of the examples 1 to 3 given in Table 1 specifically discloses a tricopolymer exhibiting a molecular weight within the range of 600 to 10000 as claimed. Moreover, it remains unclear whether the term "anti-scale agent" actually means its use in an aqueous system as claimed.

Document D2 equally fails to disclose an example which is exactly covered by the formula I $(A)_x(B)_y(C)_z$ claimed in the patent. Consequently, neither document D1 nor D2 anticipates the claimed subject matter.

As to inventive step, only document D2 specifically addresses the problem underlying the patent, i.e. protecting metal surfaces against corrosion and preventing the deposition of scale from water by adding polymers to an aqueous medium. To this end, this document teaches binary and ternary copolymers comprising maleic acid anhydride/ethyl acrylate or maleic acid anhydride/styrene exhibiting a scale inhibiting activity. Therefore, this document is regarded as being the closest prior art. However, document D2 fails to disclose a ternary copolymer which - in addition to its anti-corrosion and scale inhibiting properties - also functions as an excellent "in process" dispersion agent. This property finds particular use in the china clay industry in which it is important that slurries do not separate out appreciably during transportation from the clay pits to the client. The essential distinction between the claimed ternary copolymer $(A)_x(B)_y(C)_z$ and that of D2, therefore, is seen in the selection of a hydrophobic monomer for group C which is different to the hydrophilic monomer C vinyl acetate chosen preferably in examples 13 to 15 of document D2. Having regard to the problem underlying the patent, no inducement is found anywhere in document D2 to replace the hydrophilic vinyl acetate (component C) in examples 13 to 15 by hydrophobic monomers such as styrene, octene, nonene or dec-1-ene as claimed in the patent in order to produce a ternary polymer which provides an excellent match in the above mentioned properties. Neither was it obvious to combine examples 4 and 5 which both relate to bipolymers rather than ternary copolymers as alleged by the opponent. Also a combination of the teaching of document D2 with that of D1 cannot help in solving the above mentioned problem.

A skilled person would immediately recognise that document D1 is concerned with a totally different problem, i.e how to reduce the tendency of high molecular weight ternary polymers to deposit on agitator blades and the walls of the reaction vessel from which they are produced. Moreover, the ternary polymers disclosed in D1 exhibit a relatively high molecular weight in the range of 3000 to 400 000, preferably 5000 to 200 000, and are primarily useful in paints and adhesives. Their use as an "anti-scale agent" and "metallic corrosion inhibiting agent" are just two of eighteen possible applications which are listed in the paragraph bridging pages 5 and 6 of D1. Hence, a skilled person has no incentive to combine the teachings of documents D2 and D1. The subject matter of claim 1 of all requests therefore involves an inventive step.

VIII. The respondent argued as follows:

The isobutylene - maleic acid anhydride - methylmethacrylate ternary copolymer disclosed in document D1 falls within formula I $(A)_x(B)_y(C)_z$ claimed in the patent. In addition to the process, document D1 goes on to say on page 5 last paragraph to page 6, paragraph 2 that the resulting copolymer is available in the form of a solution or, after removal of the solvent, can be used as a dispersant, a water soluble element, an anti-scale agent or an agent for preventing metallic corrosion. These applications fully comply with the use claimed in the patent. The terms "anti-scale agent" and "agent for preventing metallic corrosion" are understood by the expert to mean "in an aqueous medium" rather than in other (organic) solvents as alleged by the appellant. According to document D1

page 3, third paragraph, per mole isobutylene 0.5 to 1.5 mol maleic acid anhydride and 0.01 to 1.5 mole methyl methacrylate are used and the molecular weight of the copolymer is of the order of 3000 to 400 000, preferable 5000 to 200 000. The later range overlaps the claimed range of 600 to 10000. The subject matter of claim 1 of the main request, therefore, lacks novelty with respect to document D1.

Even if novelty were accepted, the claimed process would not involve an inventive step having regard to the combined teaching of documents D1 and D2. Document D2 discloses the addition to an aqueous system of 0.1 to 100 ppm by weight of a terpolymer of maleic acid anhydride with two ethylenically unsaturated monomers selected, amongst others, from acrylic acid, methacrylic acid, ethyl acrylate, methyl methacrylate, styrene, alpha-methylstyrene, ethylene and propylene to prevent the deposition of scale forming materials such as $CaCO_3$ and $CaSO_4$ from water and the inhibition of metal corrosion. The molecular weight of the terpolymer is restricted to the range below 1000. It is apparent from examples 4 and 5 which relate to maleic anhydride/ethylacrylate or maleic acid/styrene bipolymers that the threshold activities of the bipolymers towards the scale forming salts $CaCO_3$ and $CaSO_4$ are different. Thus, in order to inhibit scale formation from both $CaCO_3$ and $CaSO_4$, it was obvious to a person skilled in the art to select a terpolymer comprising for example maleic anhydride/ethylacrylate/styrene, a composition which is preferred in the patent and which is encompassed by formula I $(A)_x(B)_y(C)_z$ of the main request as well as the first and the second auxiliary requests. Besides, it does not involve inventive thinking for a chemist to

replace isobutylene in the tripolymer given in D1 by an alternative monomer such as styrene which is a chemically equivalent comonomer as regards the effect described in the patent specification page 4, lines 21, 22. Hence, the subject matter of claim 1 of all requests does not involve an inventive step.

Reasons for the Decision

1. The appeal complies with the provisions mentioned in Rule 65(1) EPC and is, therefore, admissible.

2. *Amendments*

While the claims of the main request correspond to the claims of the patent as granted, amended claim 1 of the first and the second auxiliary requests derives from claims 1 and 2 in the form as granted (claims 1 and 2 as originally filed). Hence, there is no formal objection to the claims of all requests.

3. *Inventive step*

3.1 Main request

Like the patent at issue, document D2 pertains to a process for preventing corrosion of metal surfaces and the deposition of scale from water caused e.g. by calcium carbonate and sulphate. To this end, 0.1 to 100 ppm by weight of a hydrolysed ternary polymer of maleic acid anhydride (component A) with two ethylenically unsaturated monomers (components B, C) is added as a water conditioner. The two monomers B and C are selected from the group consisting of **acrylic acid,**

methacrylic acid, crotonic acid, itaconic acid, aconitric acid, **ethyl acrylate, methyl methacrylate,** other esters of said acids, acronitrile, acrylamide, vinyl acetate, **styrene, alpha-methylstyrene,** methyl vinyl ketone, acrolein, **ethylene and propylene,** and the molecular weight of the terpolymer is in the range below 1000 (cf. D2, column 3, lines 18 to 36). Among the eighteen monomers eight monomers (marked by bold letters) are within groups B and C of formula I claimed in the patent. A hydrolysed ternary copolymer of maleic acid anhydride with ethyl acrylate and vinyl acetate is especially preferred. However document D2 remains silent about the ability of the copolymers to act as a "in process dispersant" in an aqueous system. As set out in the patent at issue, the separation of aqueous slurries e.g. of china clay during transportation from the clay pits to the user can be impeded by the dispersing activity of the added polymer.

Starting from document D2 as the closest prior art, the problem underlying the patent at issue, therefore, consists in selecting from the group of monomers given in document D2 column 3, lines 23 to 26, those ternary polymers which provide an excellent match in anti-scale, anti-corrosion and dispersing behaviour. To this end, a person skilled in the art would carry out a series of comparative test runs with terpolymers of maleic acid anhydride (as component A) and would modify the two comonomers B and C within the teaching of document D2. This is routine activity for the professional chemist who is faced with the problem of checking which of the numerous ternary polymers proposed in document D2 - in addition to their known scale and corrosion inhibiting effects - also exhibit dispersing properties. This approach, however, does not

involve inventive considerations since it must be considered as forming part of normal activities of a skilled person to select the most appropriate material from the materials which are known to him as being suitable for a certain purpose. If, having regard to the state of the art, something falling within the claim had been obvious to the expert, because the prior art document (or documents) could be expected to produce an advantageous effect, such a claim would lack inventive step, regardless of the fact that a possibly unforeseen extra effect is obtained. Reference is made in this context to "Case Law of the Boards of Appeal of the European Patent Office", 3rd edition, I-D 7.7.1.

The appellant's contention that document D2 proposes in column 2, lines 42 to 49, the use of the ternary copolymer in conjunction with other additional water treatment dispersing agents has no bearing on the matter since the claimed inhibitor may be used in exactly the same way (cf. patent specification page, 5, line 16 to page 7, line 3, in particular page 5, lines 32, 33). The subject matter of claim 1 of the main request is, therefore, already obvious from document D2 taken alone.

When searching for technical solutions relevant to the problem he is confronted with, the man skilled in the art would, however, not only study documents referring to exactly the same problem, but he would also pay attention to other publications which are concerned with the same or similar types of copolymers and their application as scale and corrosion inhibitors and/or dispersing agents. The expert, therefore, would also turn to document D1 which discloses a water soluble maleic anhydride- methyl methacrylate - isobutylene

terpolymer which meets the provisions of formula I $(A)_x(B)_y(C)_z$ and which is said to be suitable as a dispersant, an anti-scale agent and an agent for preventing metallic corrosion. There is no inherent incompatibility between the teachings of documents D2 and D1. A comparison of this terpolymer with the preferred ternary polymer given in document D2 shows that component A (maleic acid anhydride) is identical and component B (methyl methacrylate) is closely related or equivalent to ethyl acrylate used in the patent in suit. Moreover, in the light of the definition given in document D2, column 2, lines 9 to 14, the skilled reader would understand that the "anti-scale agent" and "agent for preventing metallic corrosion" mentioned in document D1 act in aqueous systems. Turning to the appellant's argument that document D1 is essentially concerned with "high molecular weight ternary polymers" rather than "low molecular weight polymers, it is recalled that water solubility generally decreases as the molecular weight of the copolymer increases. Based on this general technical knowledge, it is obvious to the expert to select a relatively low molecular weight for copolymers which are to be suitable as water conditioners. This fact is also confirmed by the teaching given in document D2 to restrict the molecular weight to a range below 1000.

Consequently, the subject matter of claim 1 of the main request does not involve an inventive step in view of the combined teachings of documents D2 and D1.

3.2 First and second auxiliary requests

In claim 1 of the first auxiliary request, the monomer

of group C of formula I has been restricted to the hydrophobic group -CH_2-CH(C_{6-12})- straight or branched chain alkyl, phenyl or substituted phenyl. According to the second auxiliary request, group C is further confined to CH_2-CHC_6H_5. In the appellant's view, the hydrophobic property of monomer C in formula I plays the key role in the claimed ternary copolymer inhibitor.

The restrictions to claim 1 of the first and second auxiliary requests in fact exclude isobutylene which is present in the ternary copolymer disclosed in document D1. Since, however, isobutylene, oct-1-ene, non-1-ene, dec-1-ene or styrene are all hydrophobic monomers, they are chemically equivalent to components of the ternary copolymer as defined in claim 1 of the auxiliary requests and are expected to be interchangeable therewith. Reference is made in this context to the patent specification page 4, lines 21, 22. Moreover, no specific information is found anywhere in the patent at issue that the selection of the group CH_2-$CHC_{6-12}H_{13-25}$ or CH_2-CHC_6H_5 is associated with any particular effect, advantage or other properties going beyond those exhibited by the maleic anhydride- methyl methacrylate - isobutylene terpolymer known from document D1. It is true that an effect which may be said to be "unexpected" could be regarded as an indication of inventive step. Comparative tests submitted as evidence therefor should, however, have the closest possible structural approximation - in a comparable type of use - to the subject matter of the invention. The comparative tests enclosed with the appellant's letter of 9 July 1992 relate to binary polymers or to terpolymers comprising vinyl acetate (as component C) rather than to a ternary polymer comprising isobutylene

which, according to document D1, is said to act as a "dispersant". Therefore, these tests do not satisfy the requirement mentioned above. Given that no evidence has been produced by the appellant to prove the superiority of e.g. styrene or oct-1-ene compared to isobutylene as component C, the subject matter of claim 1 of the first and of the second auxiliary request lacks an inventive step for the same reasons as given with respect to the main request.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

V. Commare W. D. Weiß