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Datasheet for the decision of 16 December 2021

Case Number: T 1265/17 - 3.3.06

Application Number: 09174967.1

Publication Number: 2319984

IPC: D21H21/10

Language of the proceedings: EN

Title of invention:
Process for production of paper

Patent Proprietor:
Kemira Oyj

Opponents:
Stora Enso AB OYJ
Hoffmann Eitle
SOLENIS LLC

Headword:
Nanocellulose/Kemira Oyj

Relevant legal provisions:
RPBA 2020 Art. 13(2)
EPC Art. 83, 56

Keyword:
New explanation not regarded as an amended case
Sufficiency of disclosure - (yes)
Inventive step - reformulation of the technical problem - main request (no) - auxiliary request (yes)

Decisions cited:
T 2579/11

Catchword:
If a claim is unduly broadened with respect to the scope of the examples used to illustrate a technical effect, particularly when this broadening concerns the feature/s allegedly providing that effect, the burden of proof might shift back to the proprietor to prove that the effect observed in the examples would also be obtained throughout the entire scope of the claims. If no evidence is provided in this respect, a conclusion may have to be drawn on the basis of plausibility arguments (reasons 2.2.5-2.2.7).

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Case Number: T 1265/17 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 16 December 2021

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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted on 30 March 2017 concerning maintenance of the European Patent No. 2319984 in amended form.**

Composition of the Board:

Chairman J.-M. Schwaller
Members: S. Arrojo
C. Brandt

Summary of Facts and Submissions

I. Appeals were filed by opponents 1, 2 and 3 (respectively appellants 1, 2 and 3) against the decision of the opposition division to maintain European patent No. 2 319 984 on the basis of auxiliary request 1 as filed during oral proceedings on 14 November 2016, claim 1 of which **(main request)** reads:

"*1. A process for the production of paper or board comprising: adding a retention system to a stream of stock entering a paper machine headbox, directing the stream of stock to a wire, dewatering the stream of stock on the wire to form a paper web, and drying the paper web, wherein the retention system comprises a water-soluble cationic polymer, which comprises a copolymer of acrylamide or methacrylamide and a cationic monomer, the molecular weight of the cationic polymer being at least 500,000, and nanocellulose acting like a microparticle, wherein the nanocellulose is added in an amount of less than 1% as active substance based on dry solids weight of the stock, wherein the components of the retention system are added sequentially wherein the sequential addition comprises adding the water-soluble cationic polymer to form flocs, followed by subjecting the stock to shearing forces to break up the flocs and then adding the nanocellulose.*"

II. In their statements of grounds of appeal, the opponents cited new documents (hereinafter numbered D18, D20 and D21, which however are irrelevant for the present decision) and requested to set aside the decision and to revoke the patent in its entirety. They argued in

essence that the invention was insufficiently disclosed and that the subject-matter of claim 1 of the main request was not inventive in view of **D1** (Schlosser, "*Nano-disperse cellulose and nano-fibrillated cellulose - new products for paper and board manufacture and coating*", IPW 9/2008) or **D4** (WO 00/47628) combined with the teachings of D2, D9, D10, D11 or D13;
D10 (US 4,753,710) combined with D1, D2, D9 or D15;
D1 or **D7** (Schlosser, "*Nano Disperse Cellulose und Nano Fibrillierte Cellulose - neue Produkte fur die Herstellung und Veredelung von Papier und Karton*", 6/2008) combined with D2, D10 or common general knowledge in the light of D19 or D20; **D2** (Ahola et al., "*Cellulose nanofibrils-adsorption with poly(amideamine) epochlorohydrin studied by QCM-D and application as a paper strength additive*", 2007) combined with common general knowledge in the light of D20; D4 combined with common general knowledge; or D10 combined with D1 or D7 and common general knowledge, wherein:

D9: Salmi et al., "*Layer structures formed by silica nanoparticles and cellulose nanofibrils with cationic polyacrylamide (C-PAM) on cellulose surface and their influence on interactions*", 2009.
D11: WO 95/02088
D13: WO 01/3910 A1
D15: Hentze et al., "*Nano Time, aiming high with small materials*", 2008.
D19: Norell et al., Retention and Drainage, 1999.

III. In its reply dated 21 December 2017, the proprietor and respondent requested to reject the appeals and to maintain the patent on the basis of the claims upheld by the opposition division (main request) or, as an auxiliary measure, to maintain the patent on the basis of one of the auxiliary requests 1 to 5 submitted

therewith. It also requested not to admit documents D18, D20 and D21 into the appeal proceedings.

Claim 1 of auxiliary **request 1** reads:

"1. A process for the production of paper or board comprising: adding a retention system to a stream of stock entering a paper machine headbox, which stock contains chemical pulp, chemimechanical pulp, mechanical pulp or recycled fiber, or various combinations of these, directing the stream of stock to a wire, dewatering the stream of stock on the wire to form a paper web, and drying the paper web, wherein the retention system comprises a water-soluble cationic polymer, which comprises a copolymer of acrylamide or methacrylamide and a cationic monomer, the molecular weight of the cationic polymer being at least 500,000, and nanocellulose acting like a microparticle, wherein the nanocellulose is added in an amount of between 0.02 and 0.8% as active substance based on dry solids weight of the stock, wherein the components of the retention system are added sequentially wherein the sequential addition comprises adding the water soluble cationic polymer to form flocs, followed by subjecting the stock to shearing forces to break up the flocs and then adding the nanocellulose."

IV. In reply to the board's preliminary opinion that the main request and auxiliary requests 1 to 5 appeared to be obvious in view of document D10 combined with the teachings of D1, the proprietor contested the interpretation by the board of the examples in the patent.

V. Oral proceedings were held on 16 December 2021. Before the debate was closed the parties' requests were established to be as follows:

The appellants requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

The respondent requested that the appeals be dismissed or, as an auxiliary measure, that the patent be maintained on the basis of one of auxiliary requests 1 to 5 submitted with its reply on 21 December 2017.

Reasons for the Decision

1. Admittance of late filed arguments

1.1 The proprietor presented certain arguments for the first time at the oral proceedings and the opponents requested not to admit them under Article 13(2) RPBA 2020. In particular, they requested not to admit the arguments concerning tests 12 and 13 in example 10 of D10, the comparison/explanation of examples 1 and 3 of the patent and the distinction between anionic and cationic nanocellulose in D1.

1.2 According to Article 12(2) RPBA 2020, the appeal should be based on the requests, facts, objections, arguments and evidence on which the decision under appeal was based. The introduction of new arguments in the appeal proceedings can be regarded as an amendment of the case under Article 12(4) RPBA 2020, which pursuant to Article 13(2) RPBA 2020 shall, in principle, not be taken into account unless exceptional circumstances apply.

1.3 The board first notes that the arguments concerning tests 12 and 13 in example 10 of D10 and the distinction between anionic and cationic cellulose in D1 are not considered to be relevant for the present decision, so it is not necessary to decide on their admittance.

1.4 The explanation of the differences between examples 1 and 3 of the patent is however relevant to the present decision but not considered to be a new argument, but merely a reaction to the preliminary opinion of the board to support an argument which was inherently part of the first instance proceedings, namely that the examples of the patent demonstrate that the technical effect underlying the invention is that of improving retention as indicated in paragraph [0014] of the patent. In other words, the explanation of the examples of the contested patent to support the argument that the technical effect of the invention is the one alleged in the patent can hardly be regarded as an amendment of the proprietor's case pursuant to Articles 12(2) and (4) RPBA 2020, because part of the contested patent. There is therefore no basis to contest the admittance of this explanation under Article 13(2) RPBA 2020.

2. Main request - Inventive Step

The requirements of Article 56 EPC are not complied with for the following reasons:

2.1 Closest prior art

2.1.1 The opposition division concluded that document D10 should be regarded as the closest prior art. The opponents however considered that any one of D1, D2,

D4, D7, and D10 represented a valid starting point for the inventive step argumentation. While at the oral proceedings the opponents only relied on documents D1, D2 and D10, for the sake of completeness the board will take all the cited documents into consideration.

2.1.2 Document D1 discloses the use of nanocellulose as additive in paper manufacturing processes. In particular, this document indicates (pages 41 and 42, left and middle columns) that the carboxylic groups in nanocellulose provide anionic sites which counteract excess positive charges from wet cationic polymers used as wet strength agents. The introduction of anionic nanocellulose promotes reactions with the cationic wet strength agent, leading to larger particles, better retention and higher wet strength.

Document D2 discloses (pages 306 and 310-311, figure 8) the sequential addition of PAE (Poly(amideamine) epichlorohydrin) as wet strength agent and nanocellulose to form a bilayer on the fibers, thereby promoting wet and dry strength of the paper web. This improvement is said to be at least partially due to a better retention.

Document D4 discloses (page 22, lines 5-15; claims 134-153) a process for improving at least one of sizing, strength, scale control, drainage, dewatering, retention, clarification, formation, adsorbancy, film formation, membrane formation, and polyelectrolyte complexation of a paper manufacturing process by using nanocellulose. In an embodiment (example 16), the nanocellulose is combined with a cationic polymer.

Document D7 is an article by the same author as D1 concerning the use of nanocellulose as additive in paper manufacturing processes.

Document D10 discloses a papermaking process including a retention system comprising the steps of adding a cationic polymer such as polyacrylamides having a molecular weight above 500000 to the stock (col. 8, lines 40-65) to form flocs, exposing these flocs to shear forces to break them and finally adding bentonite microparticles to form new flocs (col. 7, lines 5-19).

2.1.3 For the board D10 represents the closest prior art, not only because it is the document which would require the least modifications/additions to arrive at the subject-matter of the invention, but also because it is the only cited document which discloses a paper making process with a retention system having the same sequential steps as defined in claim 1 at issue.

By contrast, D1 and D2 make no reference to the formation and breaking-up of the flocs using shearing forces, and while these documents disclose the addition of cationic polymers, these are wet strength additives (e.g. PAE) and not retention aids in the form of polyacrylamides having a molecular weight above 500000 as defined in claim 1. Furthermore, document D1 does not even disclose the sequence of addition of the polymer and the nanocellulose. All these differences appear to relate to the fact that D1 and D2 concern processes to improve wet strength rather than processes including a retention system as defined in claim 1 at issue. In view of the correlated improvement of wet strength and retention in D1 and D2, there seems to be a certain overlap between processes for improving wet strength and retention systems. In particular, both wet

strength additives and retention aids promote cross-linking of fibers, which in turn improves the retention of the fibers and additives on the wire as well as the strength of the manufactured paper web. However, while wet strength additives mainly intend to create strong bonds in the final paper web, retention systems are conceived to promote the formation of stable flocs to retain both fibers and additives on the wire while facilitating dewatering. Thus, even though there might be substances which can be used both as wet strength additives and as retention aids, processes for promoting wet strength (e.g. D1 and D2) are not the same as retention systems.

In view of the above, the board considers that a skilled person intending to develop a retention system would not choose a document dealing with processes for improving wet strength, such as D1 or D2, as starting point. Such choice would inevitably be contaminated by hindsight, and would fail from the outset because the modifications required to arrive at the subject-matter of claim 1 would essentially imply transforming a process conceived to promote the wet strength of a paper web into another process intended to maximise retention of additives and fibers on the wire.

Consequently the board concludes that neither D1 nor D2 can be regarded as the closest prior art.

Documents D4 and D7 are also not considered to represent suitable starting points, because D4 is further away from the invention than D2 (there is no disclosure of a sequential addition of the cationic polymer and the nanocellulose), and document D7 is considered to be equivalent to D1.

2.1.4 Document D10 is therefore regarded as the best starting point for assessing the inventive step of the subject-matter of claim 1 at issue, which differs therefrom in that nanocellulose is added in an amount of less than 1% as active substance based on dry solids weight of the stock.

2.2 Technical effect and problem solved

2.2.1 According to the patent in suit (see par. [0014]) the purpose of the invention is to provide an alternative substance acting like a microparticle, which results in an improved retention as compared to mineral microparticles and which is made of renewable material.

To support the alleged technical effect of improving retention the patent discloses three examples comparing processes using different dosages of bentonite (i.e. a mineral microparticle) and nanocellulose.

In particular, Example 1 shows that for equivalent dosages the use of nanocellulose gives rise to a clear improvement with respect to processes using bentonite in first pass retention (table 1) and in first pass ash retention (table 2).

Example 2 demonstrates that the use of nanocellulose also provides an improved (i.e. faster) dewatering (table 3) for all dosages when compared with the use of bentonite.

Finally, the results in Example 3 indicate that the floc stability when using nanocellulose is better than when using bentonite with dosages 1 and 2, yet worse with dosage 3.

2.2.2 The opponents argued that the results shown in said examples were insufficient to conclude that the nanocellulose improved retention with respect to bentonite. Some of the differences were insignificant (e.g. results in table 3, dosage 2) and according to Example 3, at dosage 3 the retention obtained with nanocellulose was worse than that obtained with bentonite (table 4). Furthermore, the additional tests performed during the examination proceedings (see table 1 on page 3 of the letter dated 16 September 2013) gave rise to significantly worse retention values despite being a repetition of the tests in the patent, which demonstrated that the invention did not consistently provide an improvement in terms of retention.

The subject-matter of claim 1 was also defined in very broad terms. In particular, the definition of a process which comprised an amount of less than 1% of nanocellulose effectively encompassed processes with very low amounts of nanocellulose alone or in combination with other microparticles, including bentonite. It was therefore not plausible that such embodiments would provide the technical effect of improving the retention.

The opponents concluded that the alleged technical effect of improving retention with respect to mineral microparticles would not be obtained throughout the entire scope of claim 1, so the only problem solved was to find an alternative process or, at most, an alternative process with good retention performance.

2.2.3 The proprietor argued that the improved retention in the examples was clear and significant. In particular, the retention values obtained with nanocellulose in tables 1 and 2 were not only better than those with

bentonite at an equivalent dosage, but comparable or even better than those obtained with bentonite at much higher dosages (e.g. results with dosage 2 of nanocellulose versus those with dosage 3 of bentonite in tables 1 and 2).

The results in Example 3 and table 4 corresponded to turbidity measurements related to flocs and floc stability. These measurements were indirectly related to retention, but had to be read in combination with the more direct estimation of retention in tables 1 and 2, which involved the sampling of the filtrate to measure all the additives and fibers dragged through the wire (i.e. the non-retained portion of the pulp). The combined results indicated that while the flocs and floc stability obtained with bentonite and nanocellulose were comparable (generally better with nanocellulose but slightly worse with dosage 3), the retention as such was clearly better when using nanocellulose microparticles. Thus, the process according to claim 1 provided the effect of improving retention with respect to mineral microparticles, so the problem solved by the invention was to provide a process with an improved retention.

2.2.4 In view of the above arguments, the board agrees with the proprietor that the examples of the patent show a clear improvement in terms of retention when nanocellulose is used instead of bentonite. While in its preliminary opinion the board considered that example 3 (in particular dosage 3 in table 4) appeared to imply that the effect was not reliably obtained, the subsequent explanations of the proprietor are convincing. In particular, the board agrees with its view that example 3 and table 4 do not represent an alternative way to measure retention, but rather an

estimation of flocs and floc stability, an aspect which is indirectly related to retention but which does not necessarily provide a direct measurement of the amount of additives retained on the wire. The board also agrees with the proprietor in that the first pass retention results in table 1 represent the most direct way of estimating the retention in the paper making process, because this parameter measures the proportion of additives and fibers retained on the wire. Additionally, the results in table 2 measure the retention of the filler and those in table 3 provide an indication of the dewatering speed.

Since all the above examples appear to be carried out using an identical or very similar stock (i.e. all 3 examples include stock from a fine paper machine with 45% of precipitated calcium carbonate, wherein the stock is diluted to a consistency of 8 g/L and wherein starch is added) as well as the same bentonite and nanocellulose dosages, the board agrees with the proprietor in that they should be read in combination. When the results in table 4 are read in combination with those in tables 1 and 2, it is apparent that while the formation and the stability of the flocs are similar for both bentonite and nanocellulose (i.e. one or the other being slightly better depending on the dosage), the retention as such (overall retention and filler retention) is significantly better when using nanocellulose. The board also notes that the tests submitted during examination (table 1 on page 3 of the letter dated 16 September 2013) were carried out with a different stock, which is apparent from the fact that the retention value when no microparticle is added is significantly lower than that shown in table 1 of the patent. These tests do therefore not question the validity of the examples of the patent. The board also

notes that the opponents have not filed any test report to contest the results in the examples of the patent.

In view of the above, the board concludes that the examples of the patent demonstrate that, within certain operating ranges, nanocellulose gives rise to significantly better retention values than bentonite.

However, as explained hereunder, the board agrees with the opponents in that this technical effect would not be obtained throughout the entire scope of claim 1 at issue.

2.2.5 The board considers that if a claim is unduly broadened with respect to the scope of the examples used to illustrate a technical effect, particularly when the feature/s allegedly providing that effect are broadly defined, it might be justified to shift the burden of proof back to the proprietor to demonstrate that the technical effect observed within the narrow scope of the examples would also be obtained throughout the entire scope of the claims. In the absence of specific evidence to address this issue, conclusions might have to be drawn on the basis of plausibility arguments, in particular by assessing whether the effects in the examples can be plausibly extrapolated to other technically reasonable embodiments covered by the claims. In the board's view, this approach is in line with other decisions (e.g. T 2579/11, reason 2.5.1) in which the technical effect of the invention was also determined by a plausibility check of the evidence on file.

2.2.6 According to the opposed patent (par. [0015] and [0016]), the effect of improving retention (with respect to mineral microparticles) results from the

addition of nanocellulose and of a cationic polymer to the paper pulp. While the examples of the patent illustrating this technical effect are conducted within narrow concentration ranges for these substances (300-600 g/tonne of PAM and 500-3000 g/tonne of nanocellulose/bentonite), claim 1 at issue defines the addition of nanocellulose in an amount of less than 1% or 10000 g/tonne (i.e. with an open end bottom value) and does not restrict the concentration of cationic polymer. The claimed invention therefore encompasses processes with very low amounts of nanocellulose and a broad range of cationic polymer concentrations. The question therefore arises as to whether the improved retention observed in the examples would also be obtained in some of the embodiments covered by the claims. As no further evidence has been submitted in this respect, the board considers that this question can only be answered by means of a plausibility assessment of the evidence on file.

2.2.7 The board notes that the relative improvement in retention obtained when using nanocellulose instead of bentonite is significantly affected by the concentrations of cationic polymer and nanocellulose. Looking in particular at table 1 of the patent, it can be observed that the relative improvement in retention of nanocellulose versus bentonite with dosage 1 of PAM (300 g/tonne) goes from 7,8% for dosage 2 of nanocellulose/bentonite (1500 g/tonne) to 1,7% for dosage 1 (500 g/tonne), which represents an almost 5-fold reduction of the effect with the lower nanocellulose/bentonite dosage. With dosage 2 of PAM (600 g/tonne) the relative improvement of nanocellulose versus bentonite goes from 9,2% for dosage 2 to 3,6% for dosage 1 (almost 3-fold reduction). While it would be expectable for the retention results to be dosage-

dependent in absolute terms (i.e. smaller retention for smaller dosages of nanocellulose or bentonite), the above results indicate that the relative improvement of nanocellulose with respect to bentonite decreases drastically with lower dosages of the microparticle, particularly when lower concentrations of the cationic polymer (PAM) are used. Since the relative retention improvement provided by nanocellulose is already very low (1,7%) for dosage 1 of PAM and dosage 1 of nanocellulose/bentonite, the board considers that it is not technically plausible that an improvement in retention would also be observed at significantly lower concentrations of both nanocellulose and PAM. In view of the fact that such embodiments are covered by claim 1 at issue and are not technically unreasonable, it follows that the effect of improving retention would not be plausibly obtained throughout the entire scope of the claims.

2.2.8 The board thus concludes that the only effect which would be observed throughout the entire scope of the claims is that of providing a good retention performance (no better than that obtained with other alternatives such as bentonite), so the problem solved by the invention is to propose an alternative process that has a good retention performance.

2.3 Obviousness of the solution

2.3.1 The proprietor argued that none of the documents on file suggested the use of nanocellulose as microparticles in a retention system as defined in claim 1. In particular, document D1 proposed using nanocellulose either as a positively charged microparticle or as a negatively charged microparticle only for promoting formation of large particles to

improve the filtration effect. Both mechanisms differed from the retention system in D10, in which the microparticles were added after breaking the flocs in order to promote reflocculation of more stable flocs, thereby improving retention without negatively affecting the quality of the resulting paper.

Document D19, on the other hand, did not disclose nanocellulose, but simply referred to microparticles of cellulose-based materials. Such materials were however not necessarily nanocellulose, as they could include other particulate cellulose-based material such as CMC (carboxymethyl cellulose).

2.3.2 The board does not agree with the proprietor's argumentation, because the problem solved by the invention is simply to find an alternative process with good retention performance, which implies that the only relevant question is whether the skilled person would consider using nanocellulose microparticles as a reasonable alternative or complement to the bentonite in document D10. In other words, all which is required to render claim 1 obvious is an indication in the prior art that nanocellulose can be used as an alternative or supplementary microparticle in a retention system as that described in D10.

In this respect, document D1 essentially presents nanocellulose as a recommended additive for the purpose of improving wet strength and retention when an excess of positive charges are present in the stock. While it is true that document D1 does not explicitly refer to a retention system as disclosed in D10 or as defined in claim 1 at issue, it is clear in view of the explanations on page 42, left and middle columns of D1 that the function of the negatively charged

nanocellulose in this document is analogous to that of the bentonite in D10. In particular, in both cases a cationic polymer is added to promote the cross-linking of fibers and the anionic nanocellulose is added to promote binding between different portions of this cationic polymer, thereby forming interlinked structures which improve both wet strength and retention.

The fact that nanocellulose is a known alternative to the bentonite in D10 is further supported by document D19, which represents common general knowledge and indicates that certain organic substances such as cellulose based micro- and nanoparticles can be used as an alternative to bentonite microparticles in retention systems as those described in D10. Even if, as the proprietor argued, this cellulose based micro- and nanoparticles were considered to encompass substances different from nanocellulose, a person skilled in the art would readily recognise that this reference also encompasses nanocellulose.

In view of the above argumentation, the board concludes that nanocellulose microparticles represent a known alternative to bentonite in the retention system of document D10. It would thus be obvious for a skilled person to substitute (part of) the bentonite with nanocellulose with a reasonable expectation to obtain good retention performance.

Additionally, in the absence of further guidance, the skilled person would manifestly consider nanocellulose concentrations ranges similar to those proposed in D10 (0,03 to 0,5% of bentonite according to column 10, lines 44-45) or D1 (0,1 to 0,4% of nanocellulose according to the middle column on page 42), all falling

within the range of *"less than 1%"* defined in claim 1 at issue.

The board therefore concludes that the subject-matter of claim 1 at issue is not inventive in view of D10 combined with D1 in the light of the common general knowledge illustrated in D19.

3. Auxiliary request 1 - Sufficiency of disclosure

3.1 In their written submissions, the opponents argued that the invention was not sufficiently disclosed. While this objection was not further pursued at the oral proceedings, the board will briefly address it for the sake of completeness.

3.2 The opponents essentially argued that the steps of forming flocs and exposing these to shearing forces were not sufficiently disclosed in the patent, so the skilled person would not know how to carry them out without undue burden. In particular, the patent did not provide detailed information on which specific combinations of cationic polymers and pulp should be used to form the flocs and on how to expose these flocs to the shearing conditions in order to obtain the desired technical effects. Claim 1 did also not define the size of the nanocellulose or that this substance had an anionic character, so it was unclear how this additive could be used as a microparticle throughout the entire scope of protection.

3.3 The board disagrees with the above argumentation because, as illustrated in document D19 (point 6.4.2 and figure 5), the steps of flocculation, shearing and reflocculation to promote retention are part of the common general knowledge of a person skilled in the

art, which would also find no major difficulties in selecting the appropriate cationic polymer and nanocellulose in view of the information in the patent (e.g. par. [0022] and [0030]) and/or its common general knowledge. The board therefore is not convinced by the opponent's arguments that the invention is not sufficiently disclosed.

4. Auxiliary request 1 - Inventive step

The requirements of Article 56 EPC are met for the following reasons:

4.1 Closest prior art

The reasoning and conclusions presented for the main request (point 2.1) also apply to this request, so document D10 is regarded as the closest prior art.

4.2 Problem solved by the invention

In the board's view, the restriction of claim 1 to a concentration of nanocellulose *"between 0.02 and 0.8%"* suffices to overcome the objection raised above. In particular, the definition of a bottom end value of 0,02% of nanocellulose is considered to be reasonably close to one of the exemplary embodiments (namely nanocellulose dosage 1 of 0,05%) and, most importantly, clearly excludes embodiments with very low concentrations of nanocellulose, which led to the board's conclusions that the invention according to the main request did not plausibly provide the technical effect of improving retention with respect to bentonite as shown in the examples of the patent.

Consequently, following the conclusions in point 2.2.4 above, the board considers that the invention defined in claim 1 at issue would plausibly provide the technical effect of improving retention with respect to processes using mineral microparticles such as bentonite.

Thus, the problem solved by the invention when starting from document D10 as closest prior art is to provide a paper and board manufacturing process with an improved retention performance.

4.3 Non-obviousness of the solution

4.3.1 The opponents argued that the definition of a slightly narrower nanocellulose concentration range could not be regarded as providing an inventive contribution. The range was furthermore anticipated both in D10 (which suggested bentonite concentrations of 0,03 to 0,5%) and in D1 (which recommended nanocellulose concentrations of 0,1 to 0,4%). The subject-matter of claim 1 was therefore not inventive in view of D10 combined with D1 in the light of D19.

4.3.2 The board notes that none of the cited documents provides an explicit or implicit indication that nanocellulose microparticles provide an improved retention with respect to bentonite. In particular, the general indication in D1 that nanocellulose provides an improved retention merely implies that this substance can be used to promote retention, not that it improves retention with respect to mineral microparticles such as bentonite. In fact, the only comparative reference mentioned in D1 (page 41, left col., 2nd par.) indicates that nanocellulose gives "superior benefit compared to water soluble hydrocolloids", with no

reference to mineral particles or bentonite. Document D19 discloses a list of organic polymers including cellulose that have been introduced as alternatives to colloidal silica, alumina or montmorillonite (bentonite) to be used as micro- or nanoparticles in retention systems as those defined in claim 1 at issue. In the board's view, all which can be deduced from D1 or D19 is that nanocellulose represents one of several alternative microparticles which can be used instead of bentonite. There is however no indication in these documents that nanocellulose provides a better retention than mineral microparticles such as bentonite. It must therefore be concluded that while it is apparent in view of the cited prior art that a skilled person could consider substituting bentonite with nanocellulose in D10, it would have no reason to select nanocellulose in particular among all the possible alternatives for the purpose of improving the retention performance.

For the sake of completeness, the board notes that the essential difference between the main and the first auxiliary request at issue is the problem solved by the invention. As explained above, the restricted concentration range of nanocellulose overcomes the plausibility objections raised in the discussion of the main request, implying that the problem solved by the invention is the more ambitious one of improving retention with respect to bentonite. Thus, in response to the opponents' argumentation, the board notes that it is not this narrower range which provides the inventive contribution, but the selection of nanocellulose microparticles for improving retention with respect to bentonite. In other words, while the narrower range of nanocellulose concentration does *per se* not provide a non-obvious difference, it justifies

that the more ambitious problem of improving retention with respect to mineral microparticles is solved throughout the entire scope of the claims.

The board therefore concludes that the subject-matter of claim 1 (and by the same token that of claims 2 to 8 which depend thereon) is not obvious for the skilled person in view of the cited prior art, and so involves an inventive step under Article 56 EPC.

5. Since none of the documents filed at the appeal phase by the opponents (D18, D20 and D21) is considered to be relevant to the underlying decision, there is no reason to decide on the question of their admittance.

6. Since the opponents did not raise any additional objections against auxiliary request 1 either in the written proceedings or after being consulted by the Chairman at the oral proceedings, the board concludes that the patent should be maintained on the basis of this request.

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 on the basis of claims 1 to 8 according to auxiliary request 1 submitted with the letter dated 21 December 2017 and a description to be adapted where appropriate.

The Registrar: The Chairman:

A. Pinna J.-M. Schwaller

Decision electronically authenticated