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Datasheet for the decision of 27 October 2015

Case Number: T 2163/10 - 3.3.05

Application Number: 01963895.6

Publication Number: 1326698

IPC: B01D46/52, B01D46/24, B01D39/16

Language of the proceedings: EN

Title of invention:
AIR FILTER ASSEMBLY FOR FILTERING AN AIR STREAM TO REMOVE PARTICULATE MATTER ENTRAINED IN THE STREAM

Patent Proprietor:
DONALDSON COMPANY, INC.

Opponents:
MANN+HUMMEL GmbH
Neenah Gessner GmbH

Headword:
Air filter assembly/DONALDSON COMP.

Relevant legal provisions:
EPC Art. 56, 83, 123(2)

Keyword:
Sufficiency of disclosure - (yes)
Amendments -
extension beyond the content of the application as filed (no)
Inventive step - (yes)

Decisions cited:
G 0003/14, T 0550/91, T 0085/13

Catchword:

Beschwerdekammern
Boards of Appeal
Chambres de recours

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Case Number: T 2163/10 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 27 October 2015

Appellant: (Opponent 1)	MANN+HUMMEL GmbH Hindenburgstrasse 45 71638 Ludwigsburg (DE)
Representative:	Vos, Derk Maiwald Patentanwalts GmbH Elisenhof Elisenstraße 3 80335 München (DE)
Respondent: (Patent Proprietor)	DONALDSON COMPANY, INC. 1400 West 94th Street P.O. Box 1299 Minneapolis, MN 55440-1299 (US)
Representative:	Davies, Christopher Robert Dehns St Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Party as of right: (Opponent 2)	Neenah Gessner GmbH Weldacher Strasse 30 83620 Feldkirchen-Westerham (DE)
Representative:	Bauer, Friedrich Andrae Westendorp Patentanwälte Partnerschaft Adlzreiterstrasse 11 83022 Rosenheim (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 17 August 2010 concerning maintenance of the European Patent No. 1326698 in amended form.**

Composition of the Board:

Chairman:	G. Raths
Members:	H. Engl
	P. Guntz

Summary of Facts and Submissions

I. European patent application EP 01963895.6, based on International application WO-A-02-20133, was granted with 55 claims. Date of publication and mention of grant of the patent was 30 May 2007 (Bulletin 2007/22). The subject-matter of the patent is an air filter assembly for filtering an air stream to remove entrained particulate matter.

II. Two oppositions were lodged against the European patent, based on the grounds of opposition according to Article 100(a) EPC (lack of inventive step), 100(b) EPC and 100(c) EPC. Both opponents requested that the patent be revoked in its entirety.

III. The documents cited in opposition proceedings included the following:

D1: US-A-5 672 399
D2 (E5): US-A-4 849 474
D6 (E2): DE-U1-299 07 699
D16a, D16b: Photographs of fibres
D17: Results of a web search on "Enzymol International Inc."
E1: US-A-6 090 173

IV. In the contested decision, the opposition division rejected the main request because claim 1 contravened Article 123(2) EPC.

Document D1 was considered to represent the closest prior art. Neither D1 nor E1, however, addressed the problem underlying the patent in suit, namely how to avoid the deterioration of a fine filter fiber media during pulse jet cleaning or under a long time exposure

to humidity and high temperatures. Thus, a combination of D1 and D2 or E1 was not obvious. The patent was therefore maintained in amended form on the basis of the claims of auxiliary request 1.

V. The notice of appeal of opponent I (henceforth: the appellant) and the grounds for appeal were received by letters dated 18 October 2010 and 22 December 2010, respectively.

A further submission of the appellant was received under cover of a letter dated 11 April 2014.

VI. Opponent II, party to the proceedings as of right pursuant to Article 107 EPC, did not file submissions.

VII. Under cover of a letter dated 16 May 2011, the patentee (respondent) filed observations, new claims as auxiliary requests 1 to 3 and the following new documents:

Annex 1: Table and diagrams entitled "THC for FP1-7"
Annex 3: Four diagrams showing layer efficiency vs. exposure time for polyurethane fiber layers with and without additive.

VIII. Oral proceedings before the board took place on 13 May 2014. After discussion and deliberation, the board decided to stay the procedure until an opinion of the Enlarged Board of Appeal in case G 3/14 was handed down.

IX. After the issuance of G 3/14, the parties were again summoned for oral proceedings on 27 October 2015.

X. Under cover of a letter dated 25 September 2015, the respondent filed new sets of claims as a main request and as first to fifth auxiliary requests, including adapted description pages.

XI. Oral proceedings took place on 27 October 2015.

Opponent II had previously announced that it would not attend.

The appellant submitted the following new document:

Annex I: A synoptical table of fibre properties (1 page)

The respondent filed a new main request consisting of claims 1 to 36; it also filed a sole request concerning replacement pages for adaptation of the description. All other requests were withdrawn.

XII. Independent claims 1 and 31 of the main request read as follows:

"1. An air filter assembly comprising:

(a) a housing including an air inlet, an air outlet, a spacer wall separating said housing into a filtering chamber and a clean air chamber, said spacer wall including a first air flow aperture therein:

(b) a first filter construction positioned in air flow communication with said first air flow aperture in said spacer wall; said first filter construction including an extension of a pleated filter media composite defining a filter construction inner clean air chamber;

(i) said first filter construction being oriented with said filter inner clean air chamber in air flow communication with said spacer wall first air flow aperture;

(ii) said pleated filter media composite including a substrate at least partially covered by a layer of fine fiber, the fine fiber comprising a condensation polymer, other than a copolymer formed from a cyclic lactam and a C_{6-10} diamine monomer or a C_{6-10} diacid monomer, and a resinous additive;

(A) said fiber comprising a diameter of about 0.01 to 0.5 microns such that after exposure for a period of 16 hours to conditions of 60°C (140°F) air and a relative humidity of 100%, the filter media retains greater than 30% of the fiber unchanged for filtration purposes; and

(B) the resinous additive including an oligomer having a molecular weight of about 500 to 3000 and an aromatic character wherein the additive is miscible in the polymer; and

(c) a pulse-jet cleaning system oriented to direct a pulse of air into said filter construction inner clean air chamber."

"31. A method of filtering air, the air having a temperature of at least 60°C (140°F), the method comprising:

(a) directing the air through an inlet of a housing and into a filtering chamber, the housing including a spacer wall separating the the [sic] filtering chamber from a clean air chamber, the spacer wall including a

first air flow aperture therein;

(b) after directing the air into the filtering chamber, directing the air through an extension of a pleated filter media composite of a first filter construction and into a filter construction inner clean chamber, the first filter construction being positioned in an air flow communication with the first air flow aperture in the spacer wall; the extension of a pleated filter media composite defining the filter construction inner clean air chamber;

(i) the first filter construction being oriented with the filter inner clean air chamber in a flow communication with the spacer wall first air aperture;

(ii) the media composite including a substrate at least partially covered by a layer; said layer comprising including fine fiber, the fine fiber comprising a condensation polymer, other than a copolymer formed from a cyclic lactam and a C_{6-10} diamine monomer or a C_{6-10} diacid monomer, and a resinous additive;

(A) the fiber comprising a fiber with a diameter of about between 0.1 to and 0.5 microns such that after exposure for a test period of 16 hours to test conditions of 60°C (140°F) air and a relative humidity of 100%, the media retains greater than 30% of the fiber unchanged for filtration purposes; and

(B) the resinous additive including an oligomer having a molecular weight of about 500 to 3000 and aromatic character wherein the additive is miscible in the polymer; and

(c) after directing the air through an extension of a

pleated filter media composite of a first filter construction and into a filter construction inner clean air chamber, directing the air into the clean air chamber and out of the housing;

said method further including directing a pulse of air into the filter construction inner clean air chamber to at least partially remove particles collected on the pleated filter media composite."

XIII. The appellant essentially argued as follows:

Article 83 EPC

The claim feature according to which *"the filter media retains greater than 30% of the fiber unchanged for filtration purposes"* was not disclosed in a manner sufficiently clear so that it could be reproduced by the skilled person reliably and without undue burden. The tests method disclosed in the opposed patent ("hot water soak test", "THC-bench test" and "alcohol soak test") concerned only testing of the entire filter as such, not of individual fibers. The equations of paragraphs [0147] and [0148] of the opposed patent, used for calculation of the relative amount of fine fibers which remained unchanged, related to relative contributions of the fibers and the substrate. They could not be used for calculation of the relative amount of fibers that had changed. Moreover, the degradation of the substrate depended on various other parameters such as area weight and thickness.

Furthermore, with respect to the claim feature defining a *"molecular weight of about 500 to 3000"*, it was not clear which of the definitions M_n, M_w and M_z for the molecular weight should be used. The opposed patent did

not even disclose the term "average molecular weight". According to T 85/03, a failure to indicate the proper definition of the molecular weight constituted an undue burden on the skilled person trying to reproduce the patent's teaching. Hence, the requirement of sufficiency (Article 83 EPC) was not met.

Inventive step:

The claimed subject-matter differed from D1 only in that the fine fibres did not contain a resinous, oligomeric aromatic additive of molecular weight 500 to 3,000 for making them hydrophobic. The problem of the opposed patent, starting for D1, was to make the fibres hydrophobic.

However, it was known from D2 that polyamides (e.g. nylon) compositions could be made moisture resistant and hence hydrophobic by addition of an aromatic additive, such as Bisphenol A, or an oligomeric or polymeric phenol. The skilled person would have taken D2 into account in order to solve the problem of the opposed patent.

For essentially the same reasons, claim 31 lacked an inventive step.

Article 84 EPC

The appellant put forward clarity objections against claims 1 and 31 and passages in the description. The claims also lacked support by the description and were in contradiction with the claims.

In paragraph [0040] of the amended description, the combination of the features "n = 2 to 20" and the

molecular weight range of "about 500 to 3000" had no basis in the original disclosure.

XIV. The respondent essentially argued as follows:

The objection of insufficiency of disclosure was unfounded. The opposed patent provided one test procedure for measuring the parameters of the claims. Said test involved exposure of the filter media to air having a specific temperature and humidity. It was unambiguous that the test procedure should use the THC bench test described in the description.

The respondent submitted Annexes 1 and 3 as new experimental evidence which showed that condensation polymers containing a resinous additive in accordance with the claims could successfully be made into a filter medium falling within claim 1.

With respect to the assessment of inventive step, the respondent considered E1 to be the closest prior art and most suitable starting point. E1 related to pulse cleaned filter media that have substantially the same construction as the air filter assembly of the claims now pending (as main request). In contrast, D1 concerned depth filtration media which could not be pulse cleaned.

However, taking for the argument's sake D1 as the closest prior art, the objective technical problem was the provision of a pulse jet cleaned filter capable of filtering micron and sub-micron particulate materials that showed improved filtering performance under conditions of high temperatures and high humidity.

D1 was silent on how this problem could be solved. E2

disclosed polyamide compositions having reduced water absorption and improved dimensional stability when formed into articles by injection moulding. D2 did not concern ultra fine fibers and was thus unrelated to the present patent. D2 did also not suggest resinous additives having a relatively low molecular weight.

With respect to the appellant's objections under Article 84 EPC, these could not be raised in opposition proceedings.

XV. Requests

The appellant (opponent 1) requested that the decision under appeal be set aside and that the European patent be revoked.

The respondent (patent proprietor) requested that the patent be maintained on the basis of claims 1 to 36 according to the "main request", filed during the oral proceedings of 27 October 2015; description pages 2, 10, 12, 18, 19, 26, 27 as granted, description pages 3 to 9, 11, 13 to 17, 20 to 25, 28 according to the "sole request", filed during the oral proceedings of 27 October 2015; figures 1 to 27 as granted.

Reasons for the Decision

1. Amendments

1.1 Claim 1 of the main request is based on claims 1, 12 and 13 as granted (claims 1, 13 and 14 as originally filed and published as WO-A-02/20133).

Claim 31 of the main request is based on claims 49, 50, 12 and 13 as granted (claims 50, 51, 13 and 14 as originally filed and published as WO-A-02/20133).

1.2 The amendments to the description include various deletions of text and amendments for adapting the description to the claims of the main request (page numbers refer to EP-B-1 326 698). Only the amendments which were under dispute will subsequently be discussed.

Page 9, line 50: Insertion of the molecular weight of about 500 to 3000. The appellant objected that the combination of the features "n = 2 to 20" and the molecular weight of "about 500 to 3000" had no basis in the original disclosure. However, according to te board, such a basis may be found in original claims 2, 13, 27 to 31.

The board also agrees with the respondent with respect to the examples which were retained or marked as "comparative", "reference" or "not claimed".

The board observes that in example 5, which refers to an additive comprising an oligomer of p-tert-butyl phenol of "molecular weight range 400 to 1100", that the lower value of 400 is outside the claimed range. However, the quoted passage refers to a range of molecular weights, whereas claim 1 calls for a "molecular weight of about 500 to 3000", so that no discrepancy between claim and description arises. Furthermore, paragraph [0098] indicates that the molecular weight of the additive used in Example 5 is about 600, and therefore falls within claim 1. Also, the open term "including" used in the claims does not, in the board's judgment, exclude the presence of some

oligomer having a molecular weight of from 400 to 500.

As regards Example 6, the respondent confirmed that the additive used in Example 6 was identical to the additive used in Example 5. This was not contested.

Furthermore, although certain examples do not explicitly state whether the filter media passed the tests stated in subsection (A) of claim 1, the board observes that this feature was already part of the claims as granted. The board thus sees no possibility for seeking to introduce clarifying amendments, Article 84 EPC not being among the grounds of opposition according to Article 100 EPC.

The requirements of Article 123(2) and (3) EPC are thus met.

2. Admissibility of late filed requests

(a) Set of claims of the new main request

The new main request, filed during the oral proceedings before the board on 27 October 2015, was admitted into the proceedings because it remedied an omission in independent claim 31. It was clear from the patentee's original requests, filed with letter dated 16 May 2011, that the main request was that the patent be maintained in the form as allowed by the opposition division as annexed to the decision dated 20 August 2010. The newly filed main request brings claim 31 in line with said decision.

The board therefore admitted the new request.

(b) Description pages regarding the final "sole

request"

As regards the adapted description pages according to the "sole request" filed during oral proceedings on 27 October 2015, said pages were submitted in order to address a number of objections raised by the appellant.

Said pages of the adapted description were also admitted into the proceedings.

3. Sufficiency of disclosure

3.1 Article 83 EPC stipulates that the European patent application must disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

The burden of proof for establishing insufficiency of disclosure generally lies with the opponent. As a rule, it would be necessary to identify gaps in information and show a lack of guidance in the opposed patent.

3.2 The appellant's objections are essentially twofold:

(a) The claim feature according to which *"the filter media retains greater than 30% of the fiber unchanged for filtration purposes"* could not be reproduced by the skilled person reliably and without undue burden, as the tests method disclosed in the opposed patent (i.e. the "hot water soak test", the "THC-bench test" and the "alcohol soak test") concerned only the testing of the complete filter structure, not of individual fibers.

The board considers, however, that a test procedure for testing the filter will inevitably provide important information about the behaviour of the fibers of which

the filter is composed. Therefore, this argument is not convincing.

(b) With respect to the claim feature defining a *"molecular weight of about 500 to 3000"*, it was not clear which of the definitions M_n, M_w and M_z for the molecular weight should be used.

(b.1) The appellant referred to T 85/13 (of 2 August 2005, Reasons 3.3). In that case the essence of the appellant's (opponent's) argument with regard to insufficiency of disclosure was that the patent in suit contained "*neither explicit nor implicit information as to how the molecular weight of a partially hydrolyzed poly(vinyl alcohol) mentioned in Claim 1 had to be determined. Since, however, various methods were available to determine the molecular weight (e.g. D5) and different methods might provide different values, the claimed process could not be reproduced without undue burden. Furthermore, not all the claimed poly(vinyl alcohols) solved the posed problem, namely to provide stable acrylate emulsions with high solids content.*"

The board in T 85/13 went on stating that: *"Thus, with respect to sufficiency of disclosure, the relevant question is whether the skilled person would have been able, without undue burden, to carry out the invention as defined in Claim 1 over the whole range on the basis of the information given in the patent specification and of the common general knowledge (e.g. T 550/91 of 4 April 1995, point 4.1 of the reasons; not published in the OJ EPO)."*

According to the appellant in the present case, the opposed patent contained even less information on the

kind of molecular weight of the polymer and which method should be used for determining it. Therefore, the requirements of Article 83 EPC were not met.

(b.2) The present board considers that the instant case differs from T 85/13 in the following important respect. In T 85/13 the patentee had admitted that different methods for determining the molecular weight existed and might indeed provide different values for this parameter. In the present case the burden of proof rests with the appellant to show that different methods for determining the molecular weight yielded significantly different results such that the success of the invention was jeopardized. The appellant has not discharged this burden.

The board also considers that the possibility of using different definitions M_n, M_w and M_z for the molecular weight could give rise to an objection of lack of clarity (Article 84 EPC), but in the present case this aspect was not relevant for sufficiency of disclosure (Article 83 EPC).

The board is satisfied that the requirements of Article 83 EPC are met.

4. Novelty

Novelty was not under dispute.

5. Inventive step

5.1 Invention

The patent in suit relates to an air filter assembly including a housing and a filter construction

comprising a pleated, stable, layered filter media comprising a micro- or nanofiber web layer in combination with a substrate material, and a pulse-jet cleaning system for the filter construction. The fine fibers of diameter of about 0.1 to 0.5 microns comprise a condensation polymer and a resinous additive.

The invention is based on the finding that adding certain resinous oligomeric additives, miscible with the condensation polymer, to the fine fibers improves the stability of the filter media under conditions of high temperature and humidity.

5.2 Closest prior art

According to the appellant, D1 represented the closest prior art.

Document D1 discloses (see Figure 10) an air filter assembly having a housing, an air inlet, a spacer wall, and a pleated filter media consisting of a coarse, permeable fiber layer and a layer of fine fibers of average diameter of no greater than 10 microns, preferably 0.1 to 3 microns (column 3, line 51 to column 4, line 26; column 16, lines 48 to 55). The microfibers may for example be made of polyamide fibers. D1 also mentions, in passing, pulse cleaning (see column 11, lines 30 to 46).

D1 thus discloses filter assemblies having a close structural similarity with the ones of the patent in suit. It differs essentially in that the polymeric fine fibers do not comprise an oligomeric additive.

The board can agree to D1 as the starting point for

assessing inventive step.

5.3 Problem

According to the patent in suit, the problem was to provide:

- improved materials which withstand the rigours of high temperatures of from 38°C to 120°C and up to 150°C, high humidities of from 10% to 90% and up to 100% RH (relative humidity), high flow rates of both gas and liquid, and filtering micron and sub-micron particles (ranging from about 0.01µm to over 10µm) and removing both abrasive and non-abrasive and reactive and non reactive particles from the fluid stream (see paragraph [0009], page 2, lines 53 to 57),

- in particular, polymeric materials, micro- and nanofiber materials and filter that provide improved properties for filtering streams with higher temperatures, higher humidities, high flow rates and said micron and sub-micron particulate materials (see paragraph [0010], page 2, last line, to page 3, line 3).

5.4 Solution

As a solution to this problem, the patent in suit proposes an air filter assembly in accordance with claim 1 and a method of filtering air in accordance with claim 31, characterized in that the fine fiber comprising a condensation polymer also comprises a resinous additive, the resinous additive including an oligomer being miscible in the polymer and having a molecular weight of about 500 to 3000 and an aromatic

character.

5.5 Success of the solution

5.5.1 As evidence for the success of the solution, the respondent relied on examples 5 and 6 (see in particular example 6B) of the patent under appeal which demonstrate the effectiveness of oligomeric additives in protecting fine fibers from a humid environment at 60°C, 100% humidity. While not being very good, the protection is still found to be satisfactory at 71°C (see paragraph [0095] and Figures 13 to 16).

5.5.2 The appellant did not accept that the ambitious problem as set out in the patent in suit (see 5.3) was successfully solved and reformulated the problem as to obtain more hydrophobic condensation polymers (see appeal brief of 22 December 2010, page 9, penultimate paragraph).

5.5.3 However, the board cannot agree to this definition of the problem as it contains unallowable pointers to the claimed solution.

For the board, the technical problem was in the provision of a pulse jet cleaned air filter capable of filtering micron and sub-micron particles and showing improved filtering performance under conditions of high temperature and high humidity.

With reference to examples 5 and 6, the board is satisfied that this problem has been solved.

5.6 Obviousness

It remains to be decided whether the claimed solution

is obvious having regard to the prior art.

5.6.1 Document Dl does not suggest how to improve the stability of the filters disclosed therein at high temperature and high humidity. In particular, it does not teach that polymeric fine fibres and particularly polymeric nano-fibers degrade in a hot and humid environment when used in a filter. That problem was recognised for the first time in the contested patent. Consequently, D1 does also not suggest to solve said problem by providing a resinous oligomeric additive of low molecular weight which is miscible with the fibre polymer.

The appellant pointed to document D2 as disclosing additives for condensation polymers such as nylon in order to render them moisture resistant and less susceptible to water absorption (column 1, lines 30 to 46). Thus, D2 proposes oligomeric and polymeric phenols derived from bisphenols and having a molecular weight of preferably from 400 to 30,000 (see column 4, lines 1 to 25). Injection molded parts made of polyamide 6 and polyamide 6,6 and the additive were tested for approximately 40 hrs at 75°C. Moisture absorption and dimensional expansion were significantly reduced (see columns 6 and 7).

However, these experimental results were not obtained on fine polymeric fibers (nanofibers), but on injection molded parts whose dimensional stability was analyzed. The board is not convinced that D2 provides a pointer for the skilled person to use similar oligomeric additives in order to improve the stability of sub-micron fibers in filter media. Resistance to degradation of such ultra-fine fibers is not addressed in D2. Therefore, there is no cogent reason for taking

D2 into account, in order to solve the problem posed.

5.6.2 The appellant also argued that the subject-matter of claim 1 did not solve the problem posed over the entire breadth of the claim. The language "including" would allow the presence of other additives than those explicitly defined in the claim (namely the resinous additive being an oligomer of aromatic character, being miscible with the polymer and having a molecular weight of about 500 to 3000). The claim did also not recite an effective minimum concentration for the additive. It was evident (for example from D16a/b) that the addition of a minor amount of a resinous additive (for example 0.01% of the polymer weight) would not lead to a sufficient increase of the melting point. As a consequence, low melting PUR-fibers such as Estane 5712 F30 (melting point 52°C) could not be modified by the aromatic oligomeric additive such that "30% of the fibers remain essentially unchanged for filtration purposes" after an exposure of 16 hrs to 60°C.

5.6.3 The board does not find these arguments convincing, for the following reasons. It is true that claim 1 of the patent in suit does not state an effective minimum concentration of the aromatic resinous additive. However, the examples provide an indication of typical concentrations to be used. For instance, example 5 mentions amounts of additive between 5 and 15%, relative to the polymer used, example 6 ("Surface Coated Interpolymer" uses 10% of "additive 7" and higher (see paragraphs [0108] to [0110]). In view of this teaching, the skilled person would realize that substantially lower oligomer additive additions (as suggested by the appellant) were unlikely to be effective for solving the problem posed, namely to stabilize the fine fibres against humidity and high

temperatures. The board is therefore convinced that the skilled person, after reading the patent as a whole, would be guided more closely by the examples with respect to the amount of the resinous oligomeric additive.

5.7 In conclusion, the subject matter of claims 1 to 16 meets the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is maintained in amended form on the basis of the following documents:
- claims 1 to 36 according to the "main request", filed during the oral proceedings of 27 October 2015;
- description pages 2, 10, 12, 18, 19, 26, 27 as granted,
- description pages 3 to 9, 11, 13 to 17, 20 to 25, 28 according to the "sole request", filed during the oral proceedings of 27 October 2015;
- Figures 1 to 27 as granted.

The Registrar: The Chairman:

L. Malécot-Grob G. Raths

Decision electronically authenticated