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Datasheet for the decision of 26 July 2012

Case Number: T 0660/09 - 3.2.07

Application Number: 99928117.3

Publication Number: 1095172

IPC: C23F 1/44, F01D 5/28

Language of the proceedings: EN

Title of invention:
Method of stripping a coating from a rotary seal of an aircraft engine

Patent Proprietor:
GENERAL ELECTRIC COMPANY

Opponent:
SIEMENS AKTIENGESELLSCHAFT

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (all requests - no)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0660/09 - 3.2.07

D E C I S I O N
of the Technical Board of Appeal 3.2.07
of 26 July 2012

Appellant: (Opponent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 20 February 2009 rejecting the opposition filed against European patent No. 1095172 pursuant to Article 101(2) EPC.

Composition of the Board:

Chairman: H. Meinders
Members: H. Hahn
I. Beckedorf

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal against the decision of the Opposition Division to reject the opposition against European patent EP-B-1 095 172.

II. The following documents of the opposition proceedings are cited in the present decision:

D1 = US-A-3 622 391
D8 = US-A-4 339 282
D9 = GB-A-2 115 013
D10 = GB-A-2 220 678
D18 = US-A-4 425 185
D19 = "Meyers Lexikon der Technik und der exakten Naturwissenschaften", Dritter Band O-Z, Bibliographisches Institut, Mannheim/Wien/Zürich, Allgemeiner Verlag 1970, page 2607.

III. The opposition had been filed against the patent in its entirety under Article 100(a) EPC, for lack of inventive step.

The Opposition Division held that the subject-matter of process claim 1 of the patent as granted involves inventive step over combinations of the teachings of either D8 and D1, or of D18 with D9.

IV. With a communication dated 14 March 2012 and annexed to the summons to oral proceedings the Board presented its preliminary opinion with respect to claims 1-10 of the patent as granted.

The Board remarked amongst others with respect to the issue of inventive step that it appeared that the skilled person when starting from the stripping process of the closest prior art document D18, and in order to shorten the treatment time of the process according to D18, would, by incorporating the ultrasonic vibration treatment according to D1, arrive at the method of claim 1 of the patent in suit in an obvious manner.

It had to be discussed taking account of the problem-solution approach whether or not the solution to this problem was obvious, particularly in the light of the common general knowledge of the person skilled in the art such as e.g. disclosed in D1 (i.e. that an ultrasonic agitation treatment shortens the treatment time of a chemical milling process). Further it remarked amongst others that for the alleged prejudice, withholding the skilled person from applying ultrasonic vibration to rotary seals, no supporting evidence was provided.

V. With letter dated 26 June 2012 the respondent (patent proprietor) submitted, as a response to the summons to oral proceedings, an amended main request comprising claims 1-10 and an auxiliary request comprising claims 1-9 in combination with explanations concerning the basis of the amendments made and arguments concerning inventive step, particularly with respect to the disclosure of D18 as starting point.

VI. With letter of 23 July 2012 submitted by fax on the same date the appellant argued that the features added to process claim 1 of the auxiliary request do not create subject-matter involving inventive step and

filed also a copy of D19, i.e. a definition of "ultrasonics".

VII. Oral proceedings before the Board were held on 26 July 2012. To start, in agreement with the parties the Board postponed the issue of minor formal problems under Rule 80 and Article 123(2) EPC possibly caused by the amendments made in the claims of the main and auxiliary requests. The issue of inventive step of the subject-matter of process claim 1 of the main request was first discussed, particularly on the basis of documents D1, D9, D10 and D18. This was immediately followed by the discussion of the subject-matter of process claim 1 of the auxiliary request, particularly in the light of the common general knowledge of the person skilled in the art as exemplified by D19.

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

(b) The respondent requested that the decision under appeal be set aside and the patent be maintained in amended form on the basis of one of the sets of claims filed as main and auxiliary requests with the letter of 26 June 2012.

At the end of the oral proceedings the Board announced its decision.

VIII. Claim 1 of the main request reads as follows (amendments as compared to claim 1 as granted are in bold; emphasis added by the Board):

"1. A method of stripping a nickel-aluminum coating from a rotary seal, **wherein the rotary seal (1) comprises a plurality of sealing teeth (4) for interacting with and forming a seal with a seal land (6) of an aircraft engine during rotation of the rotary seal (1),** the method comprising immersing the coated seal in a nitric acid stripping solution **(14)** containing approximately from 30 to 45 wt % nitric acid, and subjecting the stripping solution to ultrasonic vibrations **(9)**."

IX. Claim 1 of the auxiliary request reads as follows (amendments as compared to claim 1 of the main request are in bold; emphasis added by the Board):

"1. A method of stripping a nickel-aluminum coating from a rotary seal, wherein the rotary seal (1) comprises a plurality of sealing teeth (4) for interacting with and forming a seal with a seal land (6) of an aircraft engine during rotation of the rotary seal (1), the rotary seal (1) having a fundamental frequency of vibration, the method comprising immersing the coated seal in a nitric acid stripping solution (14) containing approximately from 30 to 45 wt % nitric acid, and subjecting the stripping solution to ultrasonic vibrations (9), **the method comprising directing said ultrasonic vibrations to the stripping solution at a frequency to provide an operative frequency range throughout the stripping solution (14), wherein the fundamental frequency of the rotary seal is outside the operative frequency range**."

X. The appellant argued, insofar as relevant for the present decision, essentially as follows:

With respect to inventive step the subject-matter of claim 1 of the main request is rendered obvious by a combination of the teachings of the uncontested closest prior art D18 with D1.

D18 discloses a method for a stripping treatment of nickel aluminide (NiAl comprising up to 10 wt.% Al) coated gas turbine parts. These types of coatings are stated to be utilized where there is a need for tight clearance, but the possibility of metal to metal contact exists and as a particular example the outer airseals in low pressure turbine parts of a gas turbine engine are mentioned which are typically made of a nickel superalloy, and form a circumferential ring which encircles turbine blades mounted in the spinning disc (see column 1, lines 22 to 36). Thus D18 does not explicitly mention a rotary seal but the specifically disclosed outer air seal represents a turbine engine part which interacts with a rotating part.

D18 mentions a stripping solution comprising 43-45 vol.% nitric acid which falls in the concentration range of "approximately 30-45 wt.%" of claim 1 of the main request. For the stripping process it makes no difference whether the NiAl-coating has to be removed from a part which in its use is a rotating part or a stationary part. Insofar it is not apparent how the feature "**rotary** seal" influences the claimed process of claim 1 of the main request. The prejudice concerning the more onerous cyclic stress pattern of rotary seals, which would have prevented the skilled person from applying an ultrasonic vibration treatment since it would induce further stress to the seals, as argued by

the respondent, has not been supported by any evidence. Such a prejudice is also not known from the available prior art and therefore it is not understood why D18 should address something which as such is not known.

It is clear to the person skilled in the art that various gas turbine engine parts can be treated with the process described in D18 but it is not identifiable at all why he should **not** apply this stripping process onto rotary parts such as rotary seals.

The process of claim 1 of the main request is further distinguished from that according to D18 by subjecting the stripping solution to ultrasonic vibrations.

The person skilled in the art is further taught by D18 that the stripping treatment of the nickel aluminide coating with the described solution without agitation takes about 1-5 days (see column 4, lines 33 to 34). In order to improve the throughput efficiency of the stripping process of D18 the person skilled in the art would try to shorten the treatment time by applying the suggested optional agitation treatment mentioned in D18 (see column 4, lines 30 to 32).

He is further taught by e.g. D1 that supersonic vibration will assist in this connection (see column 3, lines 43 to 46).

It is obvious that the person skilled in the art, in order to shorten the treatment time of the process according to D18, will apply agitation in the form of ultrasonic vibration as suggested in D1 for the treatment of any gas turbine engine part since D1 also

refers to parts "such as turbine nozzles, stator vanes, buckets, combustion cans, turbine disks and other components" and mentions "turbine components such as vanes" and "blades" (see D1, column 1, lines 16 to 34; column 5, lines 65 to 75; column 6, lines 5 to 12). Thereby the person skilled in the art is taught that rotating parts such as vanes or blades or turbine disks can be treated. By combining the teachings of D18 and D1 he arrives at the subject-matter of claim 1 of the main request without the exercise of inventive skills. By carrying out such a process the person skilled in the art would realise that the NiAl-coating layer is removed through the ultrasonic vibration treatment and that any further steps such as an abrasive blasting mentioned in D1 (see column 2, lines 26 to 34) are in any case no longer necessary.

Ultrasonics start at a frequency of 20 kHz (compare D19, page 2607) and the problem of damage of the seal does not occur when ultrasonic vibrations are used. The operative frequency is an automatic result of the nominal frequency applied to the acidic solution in the treatment tank, according to the example of the patent a nominal frequency of 25 kHz was used (compare patent in suit, paragraphs [0023] and [0026]). It is a simple matter of course that the operative frequency range of the ultrasonic vibrations should exclude the fundamental frequency of the seal to be treated, in order to avoid any damage thereof. Insofar the features added to claim 1 of the auxiliary request are not limiting and will automatically be met when carrying out the process which is arrived at by combining the teachings of D18 and D1. Therefore the subject-matter

of claim 1 of the auxiliary request lacks inventive step, either.

XI. The respondent argued, insofar as relevant for the present decision, essentially as follows:

None of the available prior art contains any disclosure or suggestion of the use of a method as defined in claim 1 of the new main request for stripping **rotary seals**. Rotary seals for aircraft engines are subject to significant dynamic stresses due to
i) their rotating in use at high speed (paragraph [0002] of the patent in suit mentions typical speeds of 10 000 to 15 000 rpm), and
ii) the interaction (e.g. rubbing) of the seal teeth with the seal land which induces stresses and strains in the seal itself due to rubbing of the seal teeth against the seal land. This interaction, when combined with the high rotational speed of the rotary seal means that the rotary seal is subjected to a more onerous cyclic stress pattern than most other components (for example turbine blades) of an aircraft engine which inevitably induces a higher level of fatigue damage in the seal than if the seal were subject to centrifugal rotational forces alone. The nickel-aluminide coatings on the rotary seal will be degraded in use, especially due to said rubbing interaction. Such coatings are known as being difficult to remove, with their removal requiring care in ensuring removal of the coating without damage to material of the rotary seal which underlies the coating. Further, the fatigue-inducing environment in which the rotary seal operates makes it especially important to ensure that any coating removal process does not induce unacceptable levels of

additional fatigue damage in the rotary seal. The present invention was found to result in relatively fast removal of the coating from the rotary seal through the synergistic effect of the stripping solution’s claimed concentration range of nitric acid in combination with the application of ultrasonic vibrations. Surprisingly, it was found that the latter did not induce unacceptable levels of stress/strain in the seal that would exacerbate the risk of premature fatigue failure of the seal. Hitherto, the onerous stresses/strains resulting from interaction of the rotary seal with the seal land during normal operation of the rotary seal would have led the skilled person away from considering the use of any ultrasonic vibrations when removing coatings from rotary seals.

There is no supporting evidence in the prior art with respect to the prejudice described in the patent in suit other than that it was never tried and it is admitted that no other evidence is at hand for proving the same.

It is also admitted that no evidence has been provided which would prove an increase of the life-time of rotary seals caused by the ultrasonic vibration treatment.

D18 is regarded as the closest prior art for the invention of claim 1 of the main request because, in common with the present invention, it relates to the need to remove NiAl coatings from components of gas turbine engines, in particular of outer air seals, and also indicates a desire to avoid the use of "mechanical means" (see D18, column 1, lines 45 to 47). Further, it

also discloses the use of a stripping solution containing nitric acid in the claimed concentration range but teaches a process which is slow. The general disclosure of D18's invention is related to a removal period of "less than about 7 days" (see D18, column 3, lines 20 to 29). Although D18 contains a vague reference to the optional use of agitation to "speed up processing" (see column 4, lines 30 to 32), there is no indication as to what form this agitation might take. There is certainly no teaching of the use of ultrasonic vibrations to induce coating removal. Further even the "best mode" outlined in D18 defines a multi-stage process of repetitive immersion of the component to be stripped in the stripping solution followed by removal, rinsing and vapour blasting, with this process repeated until the coating is removed (see D18, column 3, lines 30 to 47). In contrast, the method of the present invention has the advantage that it results in removal of the coating without requiring additional process steps. D18 is silent with respect to ultrasonic vibrations, let alone in combination with a stripping solution to induce coating removal from components which are subject to the onerous fatigue-inducing operating regime of the rotary seal of the claimed method.

The non-continuous contact of a turbine blade with an outer air seal should not be compared with that of a rotary air seal which continuously contacts the seal land and thereby suffer more from fatigue stress.

Therefore the subject-matter of claim 1 of the main request involves inventive step.

Claim 1 of the auxiliary request incorporates the amendments made in the main request and defines the rotary seal as "having a fundamental frequency of vibration" and the further step of "directing said ultrasonic vibrations to the stripping solution at a frequency to provide an operative frequency range throughout the stripping solution, wherein the fundamental frequency of the rotary seal is outside the operative frequency range" (compare patent in suit, paragraph [0026]).

Provided that the fundamental frequency of the rotary seal is avoided no fatigue stress will be imposed on the seal during the ultrasonic treatment. It is admitted that this represents a prerequisite for applying the claimed process.

The patent describes using ultrasonic vibrations at a nominal frequency of 25 kHz and describes the variation in frequency that occurs within the tank containing the stripping solution and describes that the fundamental frequencies for both rotary seals were outside the "operative range of the tank" (which was from 16-23 kHz), i.e. outside the range of frequencies present throughout the stripping solution due to imparting ultrasonic vibrations at the nominal frequency (see patent in suit, paragraphs [0022] to [0026]). Claim 1 defines the operative frequency range and not the nominal frequency.

The final submission by fax of the appellant dated 23 July 2012 had not reached the representative, but he did not question the fact it had been directly sent to him by the appellant.

D10 discusses varying the frequency of the ultrasonic vibrations to increase the cleaning efficiency on components, however, having internal passages or cavities in the treated turbine parts.

Hence the subject-matter of claim 1 of the auxiliary request involves inventive step since it is not suggested by the prior art.

Reasons for the Decision

1. *Admissibility of amendments (Rule 80 and Articles 123(2) and (3) EPC)*

Since the Board comes to the conclusion that the subject-matter of claim 1 of the main and auxiliary requests lacks inventive step (see point 2 below) there is no need to discuss whether or not the claims of these requests or the amendments made therein comply with Rule 80 and Articles 123(2) and (3) EPC.

2. *Inventive step (Article 56 EPC)*

Main request

2.1 From the wording of claim 1 of the main request it is clear that it is **not** restricted to the method steps defined therein, as it reads: "A method of stripping a nickel-aluminium coating …, the method **comprising** …" (see point VIII above).

Consequently, all the respondent's arguments that any additional method steps would be excluded from claim 1 of the main request, e.g. that manual scrubbing is not used or that vapour blasting need not be applied, cannot hold.

2.2 The Opposition Division based its acknowledgment of inventive step of the subject-matter of claim 1 as granted (which also did not exclude any further process steps due to the identical formulation "the method **comprising** …") on the unproven **prejudice** that "**rotary** seals" cannot be subjected to ultrasonic vibrations during the stripping of NiAl-coatings from (superalloy) substrates.

2.2.1 The respondent argued that this prejudice would be implied by the fact that these rotary seals are parts from an aircraft engine and the "ultrasonic treatment can potentially reduce the high cycle fatigue life of the part" and therefore only stationary parts (see D9) have been stripped in combination with such an ultrasonic treatment (see patent in suit, paragraphs [0001], and [0004] to [0005]).

In the patent in suit (see paragraph [0006] wherein D10 is cited and briefly described) it is, however, also mentioned that **moving** turbine parts such as **turbine blades** have been cleaned in combination with an ultrasonic treatment; the turbine blades are immersed in a cleaning bath comprising 50% nitric acid (see D10, page 5, third paragraph to page 6, first paragraph). This fact has apparently been ignored in the impugned decision. The disclosure of D10 thus casts doubt on the alleged prejudice since the (rotating) turbine blades

can be (respectively are) made from the same (superalloy) material as the rotary seal substrates and due to their rotation they are exposed to a similar fatigue stress pattern as the rotary seal.

2.2.2 According to the longstanding practice of the Boards of Appeal the burden is on the patent proprietor to demonstrate by reference to suitable evidence that the prejudice alleged by it really exists (see Case Law of the Boards of Appeal of the European Patent Office, 6th edition 2010, section I.D.9.2).

2.2.3 The Board mentioned the lack of support for the alleged prejudice in point 3.2 of its communication annexed to the summons to oral proceedings. The respondent did **not** address this issue at all in its response thereto. The deficiency of missing supporting evidence has also not been overcome at the oral proceedings, in which the respondent's representative eventually admitted that any evidence to prove the same is not at hand.

Hence the existence of a prejudice has **not** been demonstrated by the respondent.

2.2.4 Consequently, any respondent's arguments based on this unproven prejudice need not be considered for the discussion of inventive step.

2.3 It was uncontested by both parties that D18 represents the closest prior art for the process of claim 1 of the main request.

2.3.1 D18 discloses a method for stripping nickel aluminide coatings (NiAl coating comprising a base of nickel with

up to 10 wt.% Al) from gas turbine parts for subsequent refurbishing (see column 2, lines 47 to 63). These nickel aluminide coatings are stated to be utilized where there is a need for tight clearance, but the possibility of metal to metal contact exists. As a particular example the outer airseals in low pressure turbine parts of a gas turbine engine are mentioned which are typically made of a nickel superalloy, and form a circumferential ring which encircles turbine blades mounted in the spinning disc (see column 1, lines 22 to 36). D18 does not mention a rotary seal having a plurality of sealing teeth. The specifically disclosed outer air seal mentioned in D18 represents, however, a turbine engine part which interacts with rotating turbine blades.

The stripping solution according to D18 comprises 43-45 vol.% nitric acid (taking account of the disclosed conc. HNO_3 of 40° Baume - see column 3, line 51 - which comprises about 65 wt.% nitric acid, this range corresponds to about 28-29.3 wt.%) which falls in the concentration range of "**approximately** 30-45 wt.%" specified in claim 1 of the main request, as agreed to by the respondent.

The stripping treatment of the nickel aluminide coating with the described solution at room temperature takes about 1-5 days without agitation (see column 4, lines 33 to 34). It mentions a treatment time of about 72-120 hours at 20°C for removing a coating of about 6 mm thickness (see column 2, line 67 to column 3, line 3). Optionally agitation of the solution can be used to speed up processing (see column 4, lines 30 to 32).

2.3.2 The claimed method of claim 1 of the main request is thus distinguished from that of D18 by:

i) defining a rotary seal having a plurality of sealing teeth which during its use in an aircraft engine interacts with the stationary part of the engine, and

ii) in that the stripping solution is subjected to ultrasonic vibrations.

2.3.3 A particular effect of the feature i)"a **rotary** seal having a plurality of sealing teeth …" has not been demonstrated by the respondent. This is due to the fact that firstly the patent in suit is silent in this respect and secondly the alleged prejudice against ultrasonic vibration stripping of rotating seals because of the more onerous cyclic stress pattern they are subjected to has not been proven (see point 2.2.3 above).

Even starting from the position of the respondent that feature i) is distinguishing the method of claim 1 from the method of D18, the Board considers that the skilled person would apply the latter to rotary seals, as D18 relates already to outer airseals in turbines. As already mentioned, evidence of a prejudice against doing that could not be given. Also D1 shows that such methods are frequently applied to other parts of turbines. The same applies for turbine blades, see D10, as acknowledged in paragraph [0006] of the patent in suit, and in D8. See also point 2.5.1 below for a more extensive discussion of these documents.

In this context it is also noted that the Board in point 3.3 of its communication remarked that it does not appear that the operational life time of any such ultrasonically stripped rotary seal is increased compared to another one being conventionally treated without ultrasonic treatment (e.g. by manual scrubbing as mentioned in the patent in suit, see paragraph [0007]). The fact that no evidence for such an improvement is at hand has been acknowledged by the respondent at the oral proceedings.

Shorter treatment times cannot help distinguish the claimed method either, as the latter does not exclude ("comprising") further method steps, see also point 2.5.5 below.

2.3.4 Feature ii) causes a reduction of the treatment time of the rotary seal in the bath (see patent, paragraph [0007]) so that a seal having its - 0.05 to 0.15 mm thick - NiAl coating stripped away can be obtained after 3.5 to 4 hours (see patent, paragraph [0020] in combination with paragraph [0017]). Thus feature ii) provides a more economic stripping process.

2.4 The objective technical problem to be solved is therefore the provision of a more economic stripping method by shortening the treatment time.

2.5 The solution to this problem is obvious for the following reasons:

2.5.1 From the teaching of D18 it is clear to the person skilled in the art that the described process is suitable for treating various gas turbine engine parts.

Nothing in its text speaks against applying it to rotary parts of an aircraft engine such as turbine blades or rotary seals. The outer air seal mentioned in D18 - although being a stationary part of the gas turbine engine - interacts with the rotating turbine blades (compare in this context figure 1 of the patent in suit: the outer air seal of D18 may correspond to the seal land 6 which interacts with the plurality of seal teeth 4 of rotary seal 1, the latter being the equivalent of the turbine blades in D18) and will therefore also experience a certain dynamic stress during its use (which is expected to be similar to that of the rotary seal since the velocity of the rotating part can be or should be identical, only the rubbing action may be different; the same conclusion holds true with respect to the rotating turbine blade).

Taking account of the passage in D18 dealing with the outer air seals, typically made of a nickel superalloy, which encircle turbine blades mounted in the spinning disc (see column 1, lines 22 to 36) and further considering the background art described in D18 - wherein amongst others D8 is referred to (see D18, column 2, lines 15 to 24) which describes the stripping treatment of turbine blades with a similar solution comprising 43-48 vol.% concentrated nitric acid (see D8, column 1, lines 11 to 40 and column 2, lines 29 to 41) - it is clear to the person skilled in the art that these gas turbine engine parts also include rotating aircraft engine parts since they can also have the described protective NiAl coating on a superalloy substrate.

2.5.2 D1 discloses an improved stripping process for removing aluminide coatings from cobalt base and nickel base superalloys in an aqueous bath comprising nitric acid (see abstract; column 1, line 16 to column 2, line 10; column 2, lines 40 to column 3, line 12; column 3, line 63 to column 4, line 32; column 6, lines 5 to 13; claims 1-8). D1 mentions that more effective stripping can be promoted by agitating the stripping solution and that supersonic vibration will assist in this connection (see column 3, lines 39 to 46).

2.5.3 In order to make the stripping process of D18 more economic the person skilled in the art would therefore try to shorten its treatment time by applying an agitation treatment which is mentioned in D18 as being optional (see column 4, lines 30 to 32).

Being further taught by D1 that "supersonic vibration" (which is synonymous to "ultrasonic vibration") will assist in this connection it is obvious that the person skilled in the art will apply the optional agitation of D18 in the form of ultrasonic vibration as suggested in D1 for the treatment of any gas turbine engine parts having a NiAl coating.

This holds the more true since D1 also refers to parts "such as turbine nozzles, stator vanes, buckets, combustion cans, turbine disks and other components" and mentions "turbine components such as vanes" and "blades" (see D1, column 1, lines 16 to 34; column 5, lines 65 to 75; column 6, lines 5 to 12). The person skilled in the art is thus also taught by D1 that rotating parts such as vanes or blades or turbine disks,

which are also subjected to dynamic stress, can be treated in combination with ultrasonic vibration.

By applying the teaching of D1 in the method of D18 the person skilled in the art arrives at the subject-matter of claim 1 of the main request without the exercise of inventive skills.

2.5.4 By carrying out the process based on the combined teachings of D18 and D1 the person skilled in the art would realise that the NiAl coating layer is already removed through the ultrasonic vibration treatment so that any further steps, such as an abrasive blasting mentioned in D1 (see column 2, lines 26 to 34) or a vapour blasting as mentioned in D18 (see column 3, lines 34 to 47), are no longer necessary.

2.5.5 The respondent's arguments to the contrary cannot hold for the following reasons.

Although the general disclosure of D18's invention is about a removal period of "less than about 7 days" (see D18, column 3, lines 20 to 29) it contains a clear reference to the optional use of agitation to "speed up processing" (see column 4, lines 30 to 32). There is no need that document D18 itself teaches the use of ultrasonic vibrations to induce coating removal.

The arguments concerning the "best mode" outlined in D18, i.e. a multi-stage process of repetitive immersion of the component to be stripped in the stripping solution followed by removal, rinsing and vapour blasting, being repeated until the coating is removed (see D18, column 3, lines 30 to 47), are not

particularly relevant in view of the open definition of claim 1 of the main request "the method **comprising** …" which does not exclude further process steps (see point 2.1 above).

2.5.6 Consequently, the subject-matter of claim 1 of the main request lacks inventive step. The main request is therefore not allowable.

Auxiliary request

2.6 At the oral proceedings, during the discussion of inventive step of claim 1 of the auxiliary request, the respondent stated that it had not obtained the last submission of the appellant dated 23 July 2012 including D19. The Board verified the file and, as derivable from the EPO transmission report in the file, this letter (received at 9:21 hours that day) had been transmitted by fax that same day at 12:11 hours to the office of the respondent's representative.

However, as a result of this the appellant presented the content of said letter orally to the respondent who was thus in a position to respond to these arguments; he further did not object to this procedure.

2.7 Claim 1 of the auxiliary request comprises additional features defining the ultrasonic vibrations to be at a frequency to provide an operative frequency range throughout the stripping solution so that the fundamental frequency of the rotary seal is outside the operative frequency range (see point IX above).

The Board comes to the conclusion that also the subject-matter of claim 1 of the auxiliary request lacks inventive step over a combination of the teachings of D18 and D1 for the reasons that follow.

2.7.1 D1 suggests the use of ultrasonic vibrations and it belongs to the common general knowledge of the person skilled in the art that ultrasonics starts at a frequency of 20 kHz (compare D19, page 2607).

2.7.2 According to the example of the patent in suit a nominal frequency of the ultrasonic vibrations of 25 kHz was used which resulted in an operative frequency in the tank (when an engine part was placed at the center of the tank) of from 18 to 23 kHz (compare patent, paragraph [0026]) while the fundamental frequencies and almost all the significant harmonics of the two tested rotary seals were below 15 and 18 kHz, respectively (compare patent, paragraph [0023]).

2.7.3 First of all, it is a simple matter of course that the operative frequency range of the ultrasonic vibrations in the stripping bath should exclude the fundamental frequency of the seal to be treated, in order to avoid any damage thereof. Furthermore, as stated by the respondent, no fatigue stress is added to the seal during the ultrasonic treatment provided that the fundamental frequency of the rotary seal is avoided.

At the oral proceedings, when questioned by the Board the respondent admitted that this relationship of the ultrasonic vibrations represents a prerequisite for applying the claimed process.

2.7.4 Secondly, the problem of damage of the seal does not occur when ultrasonic vibrations are used since, as proven by the aforementioned example of the patent in suit, the operative frequency is an automatic result of the nominal frequency applied to the seal in the acidic solution contained in the treatment tank. This nominal frequency is dampened by the geometry of the used tank, the stripping bath and the geometry and size of the seal holder. The respondent did not contest this conclusion of the appellant at the oral proceedings.

2.7.5 Taking account of these considerations the features added to claim 1 of the auxiliary request are considered to automatically result when carrying out the process resulting from combining the teachings of D18 and D1.

2.7.6 Consequently, also the subject-matter of claim 1 of the auxiliary request lacks inventive step. The auxiliary request is therefore not allowable.

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. Nachtigall H. Meinders