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**D E C I S I O N**  
of 12 July 2001

**Case Number:** T 0374/98 - 3.2.2

**Application Number:** 92902262.2

**Publication Number:** 0567486

**IPC:** C03B 37/05

**Language of the proceedings:** EN

**Title of invention:**  
Process and apparatus for making mineral wool fibres

**Patentee:**  
Rockwool International A/S

**Opponent:**  
(I) Paroc Oy Ab  
(II) RHI AG

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 83, 56

**Keyword:**  
"Sufficiency of disclosure (yes)"

**Decisions cited:**  
-

**Catchword:**



Case Number: T 0374/98 - 3.2.2

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.2  
of 12 July 2001

**Appellant I:** Paroc Oy Ab  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 16 February 1998  
rejecting the opposition filed against European  
patent No. 0 567 486 pursuant to Article 102(2)  
EPC.

**Composition of the Board:**

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

## Summary of Facts and Submissions

- I. European patent No. 0 567 486 was granted on 12 July 1995 on the basis of European patent application No. 92 902 262.2.
- II. The grant of the patent was opposed on the grounds that it did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 100(b) EPC) and that its subject-matter lacked novelty and did not involve an inventive step with respect to the state of the art (Article 100(a) EPC).
- III. With its decision posted on 16 February 1998 the opposition division held that said grounds for opposition did not prejudice the maintenance of the patent and rejected the oppositions.
- IV. An appeal was lodged against this decision on 7 April 1998 by appellant I (opponent I: PAROC OY AG) and on 4 April 1998 by appellant II (opponent II: RHI AG). The notices of appeal were followed by the statement of grounds submitted on 12 June 1998 by appellant I and on 10 June 1998 by appellant II.
- V. In addition to the documents mentioned in the decision of the opposition division:

D1: US-A-3 159 475  
D2: WO-A-90/15032  
D3: US-A-4 238 213

the following documents have been relied upon on appeal:

- D4: WO-A-88/07980
- D5: GB-A-673 561
- D6: GB-A-999 119
- D7: US-A-3 303 009
- D8: SE-A-0 403 099 & US-A-4 119 421
- D9: US-A-2 641 028
- D10: WO-A-92/10436
- D11: GB-A-1 559 117 (cited in the patent)
- D12: JP-A-63-230 535.

VI. Oral proceedings were held before the Board on 12 July 2001.

The appellants requested that the decision under appeal be set aside and that the European patent No. 0 567 486 be revoked.

The respondent (patentee) requested that

- the decision under appeal be set aside and
- the patent be maintained on the basis of the main request submitted during the oral proceedings or, in the alternative, on the basis of the first or the second auxiliary request submitted during the oral proceedings; and
- documents D4 to D11 be excluded from the proceedings.

VII. Independent claims 1 and 8 of the main request read as follows:

"1. Fiberising apparatus for forming mineral wool comprising a set of four rotors (4,5,6,7) each mounted for rotation about a different substantially horizontal axis and arranged such that when the rotors are rotating melt poured on to the periphery of the top

rotor (4) in the set is thrown on to the periphery of the subsequent rotors in turn and fibres are thrown off the rotors,

characterised in that the top rotor (4) is provided with driving means and has a size such that it can rotate to give an acceleration field of at least  $50 \text{ km/s}^2$  and the subsequent rotors (5,6,7) each have a size and can rotate such as to give a greater acceleration field than the top rotor (4), and the axes of the first and second rotors (4,5) are arranged such that a line drawn from the axis of the first rotor (4) to the axis of the second rotor (5) makes an angle (C) of from  $0^\circ$  to  $20^\circ$ , preferably  $5^\circ$  to  $10^\circ$ , below the horizontal."

"8. A process for making mineral wool using apparatus comprising a set of least three rotors (4,5,6,7) each mounted for rotation about a different substantially horizontal axis and arranged such that when the rotors are rotating melt poured on to the periphery of the top rotor (4) in the set is thrown on to the periphery of the subsequent rotors in turn and fibres are thrown off the rotors, wherein the process comprises pouring mineral melt having a temperature of from  $1300$  to  $1700^\circ\text{C}$  on to the top rotor (4) and collecting as wool the fibres that are formed and wherein the subsequent rotors (5,6,7) have a size and rotate at a speed such that they give a greater acceleration field than the top rotor (4),

characterised in that the top rotor (4) has a size and is rotated at a speed such that it gives an acceleration field of  $50 \text{ km/s}^2$  to  $150 \text{ km/s}^2$  and the axes of the first and second rotor (4,5) are arranged such that a line drawn from the axis of the first rotor(4) to the axis of the second rotor (5) makes an angle (C) of from  $0^\circ$  to  $20^\circ$ , preferably  $5^\circ$  to  $10^\circ$ , below the horizontal and the angle B is from  $40^\circ$  to  $65^\circ$ ."

Independent claim 1 of the first auxiliary request corresponds to claim 1 of the main request but additionally comprises the wording (in bold letters):

"1. Fiberising apparatus for....below the horizontal and in which the sum of C, D, E, and F is from 120 to 150°."

Claim 1 of the second auxiliary request corresponds to claim 8 of the main and of the first auxiliary request including in line 23 the term "acceleration field of above 50 km/s<sup>2</sup>".

VIII. The appellants argued as follows:

Given that two different technical terms, namely "acceleration force" and "acceleration field" are used in the opposed patent, its disclosure is contradictory and it remains unclear which kind of parameter is actually meant. More particularly, the surface of the rotors can either exhibit a cylindrical shape, or alternatively, it can be provided with ridges, grooves or a specific profile resulting in a smaller inner and a larger external diameter. Given that the acceleration field exerted on a drop of mineral melt varies considerably when hitting either the external or the inner diameter of the rotor, the skilled worker is left very well short of the manner in which the acceleration field is to be actually determined. Objection, therefore, arises under Article 100(b) EPC.

As to the inventive merit of the opposed patent, the problem of reducing the formation of "shot" and of producing "fine" fibres for mineral wool has always been a major focus ever since for the rock and slag wool industry. Document D1 which is considered as being the closest prior art as well as document D3 both

address the same problem. The apparatus claimed by the main and the auxiliary request differs from that disclosed in document D1 by comprising four rotors (compared to 3 rotors in D1), by the capability of the first rotor to operate at an acceleration field of at least  $50 \text{ km/s}^2$  and, as set out in first auxiliary request, by the sum of angles C, D, E, and F being from 120 to 150°. Spinners with four rotors are well known in the art, e.g. from document D3, and do not constitute a fundamental difference to embodiments comprising three rotors. Apart from the optional feature that the first rotor is provided with a driving means and has a size so that it "can rotate" to produce the aimed acceleration field, such a high acceleration value is already disclosed in document D3 to provide fine, essentially shot free fibres. Given that the same general type of rotor configurations are used for the fiberisation of mineral melts and refractory melts, it would take no imagination for a skilled person, faced with the above problem, to enhance the acceleration field. Moreover, the sum of angles C, D, E and F featuring in claim 1 of the first auxiliary request merely purports to describe a specific technical feature. Having regard to the angular arrangement of the rotors in the apparatuses for forming fibres according to the prior art, the claimed sum of angles appears to be imperative with respect to an optimum fibre formation. The claimed subject-matter, therefore, lacks an inventive step.

IX. The respondent argued as follows:

As regards the insufficiency of disclosure alleged by the opponents, the patent gives a clear definition of the term "acceleration field" or "centripetal acceleration" by the formula on page 4, lines 1 to 11 of the description. Insofar as the term "acceleration force" has been erroneously used which might have

created some uncertainty, this term should be replaced by "acceleration field". The skilled reader clearly deduces from the unit " $\text{km/s}^2$ " that only the acceleration field can have been meant.

Turning to the rotor surface, a cylindrical non-profiled surface is used in the patent. But even supposing that there is profiling of the surface, the skilled worker is still able to interpret the term "acceleration field" in a meaningful manner and will define an "Effective Diameter", see document D1, column 3, lines 28 to 49. The patent is, therefore, sufficiently clear and complete for it to be carried out by a skilled person.

When compared with the claimed apparatus, document D1 as closest prior art discloses only a three-rotor spinning apparatus whereby the highest possible acceleration field suggested for the first rotor is below  $15 \text{ km/s}^2$  which is one third of that of the claimed rotor. Moreover, document D1 teaches that the formation of fibres should not occur on the first rotor and, therefore, dissuades from increasing the acceleration field. It should, therefore, be judged whether it was obvious to modify this apparatus in order to bring its details within the scope of claim 1. In fact, document D3 discloses a fibre spinning apparatus including a first rotor that can provide the claimed acceleration field. However, document D3 is concerned with the production of refractory (ceramic fibres) rather than mineral wool, and a relationship between the manufacture of ceramic fibres and mineral wool is technically wrong. As to the angle C featuring in claim 1 of the patent, the range of  $0^\circ$  to  $20^\circ$  and also the sum of the angles  $C+D+E+F$  are not an arbitrary selection as alleged by the opponents. Rather, these angles are essential to have the melt passed in an optimal way through the apparatus. Even if, for the



sake of argument, a larger diameter of rotor (6) of the apparatus according to document D1 were chosen to increase the acceleration field, this would inevitably result in an angle A greater than 20°, thus leading to an angle C outside the claimed range for rotors 4 and 5. Hence, the claimed apparatus is not obvious from the combined teaching of the prior art cited by the appellants.

### Reasons for the Decision

1. The appeal is admissible.
2. *Late-filed documents*

According to the patentee's request, documents D4 to D11 should be not be admitted since they are late-filed.

However, given that appellant I has already relied upon documents D4 to D9 and D11 in its notice of opposition, it would be unjustified to exclude these documents from the appeal proceedings. Appellant I cited document D10 for the first time in its statement of grounds of appeal. Since the Board did not consider this document *prima facie* as highly relevant, it has been disregarded in the appeal proceedings.

As all parties agreed with the Board's view that document D12, submitted only one month before the oral proceedings by opponent I, has been *prima facie* highly relevant to the claimed subject-matter, this document has been admitted to the proceedings.

3. *Disclosure of the invention (Article 83 EPC)*

Although the use of the two terms "acceleration force" and "acceleration field" in the description of the patent at issue might create some confusion, it, nevertheless, unambiguously and clearly results from the formula given on page 4 of the patent specification in combination with the dimension "km/s<sup>2</sup>" that nothing else could have been meant than the "acceleration field" and how it is to be calculated.

Turning to the possible peripheral surfaces of the top rotor, in the case of a cylindrical roll,  $r$  means the maximum radius of the rotor in the formula  $\Omega = 2\pi n/60$ . If, as distinguished from the cylindrical form, the surface of the rotor exhibits a frustro-conical or contoured profile including grooves, ridges etc that result in an inner and outer radius,  $r$  stands for the mean radius (or "effective radius") to which the major portion of the molten mineral is discharged. Reference is made in this context to document D1, column 3, lines 28 to 49 which specifically deals with the "effective diameter".

Consequently, the requirements of Article 83 are met by the disclosure of the patent at issue.

4. *The closest prior art*

Like the patent at issue, document D1 is concerned with a fiberising apparatus for forming mineral wool including three rotors whereby each rotor can rotate to give a greater acceleration than the top rotor and wherein the angle A (corresponding to angle C in the patent) is about 19°. Moreover, document D1 addresses the same problem as claimed, namely the collection of long, relatively shot-free fibres and to avoid substantial uncontrolled spattering of the molten

material (cf. D1, column 1, lines 9 to 20, 52 to 57, 64 to 70; column 2, lines 55 to 61; column 4, lines 20 to 22 and lines 28 to 31). Consequently, document D1 represents the closest prior art.

The claimed fibre spinning apparatus differs from this prior art by (i) a set of four rotors and (ii) the capability of the first rotor to provide an acceleration field of at least  $50 \text{ km/s}^2$  (according to the main request); and, in addition to (i) and (ii), by (iii) the sum of angles C+D+E+F (according to the first auxiliary request).

5. *Inventive step (main and first auxiliary request)*

The problem addressed by the patent at issue which consists in minimizing or even avoiding the formation of shot during the production of mineral wool is an object which is common to every fibre spinning apparatus (cf. e.g. D5, page 1, lines 48 to 56; D6, page 1, lines 46 to 52; D7, column 2, lines 23 to 29). Therefore, the problem per se is known in the art.

As to feature (i), the patent specification mentions on page 3, lines 47 to 50 that there are normally three or four rotors in the set when making mineral wool. Thus feature (i) merely represents the state of the art. Moreover, given that - compared with a three rotor set - the patent fails to disclose any particular advantage or effect associated with the use of a four rotor set, there is no basis for implying that feature (i) has an inventive character.

Turning to feature (ii), it is generally known in the art that the yield and the fineness of the mineral fibres obtained from a rotor is determined by the rotational speed of the rotor and by its ability to accelerate the layer of mineral melt present on the

rotor up to the peripheral velocity of the rotor prior to its ejection therefrom (cf. e.g. document D5, column 1, lines 40 to 55; see also D2, page 2, last paragraph, lines 4 to 6 and page 3, paragraphs 2 and 3). This finding is also true when producing aluminium silicate (refractory) fibres, as can be noted from document D3, column 4, lines 22 to 29; column 6, lines 29 to 54. To this end, the rotors of the spinning apparatus - which according to D3 can comprise two, three or four rotors (cf. D3, column 3, lines 45 to 53) - are turned to create a circumferential speed of e.g. 17800 linear feet per minute corresponding to 8500 rpm (revolutions per minute). Thus, an 8 inch top rotor (diameter 20 cm) can provide an acceleration field  $G = r\Omega^2$  of 79,2 km/s<sup>2</sup> which is above the claimed minimum limit of 50 km/s<sup>2</sup> (cf. D3, column 5, line 63 to column 6, line 3). Furthermore, the passage in document D3, column 1, lines 36 to 42 reflects the experience that the same general type of rotor configurations is used for the fiberisation of mineral fibres and refractory fibres, although specific problems are associated with the spinning of aluminium silicate melts. All these considerations lead to the conclusion that it would be obvious to provide the apparatus given in document D1 with a top rotor that is capable of creating a very high acceleration field irrespective of the material to be fiberised. Hence, the subject-matter of claim 1 of the main request lacks an inventive step with respect to the combined teaching given in documents D1 and D3.

Claim 1 of the first auxiliary request further defines the sum of the angles C+D+E+F to cover values between 120° to 150°. Apart from the fact that feature (iii) is rather broad since it relates to the "sum of angles" and thus allows a wide variation of the single angles C, D, E and F, the path on which the melt travels in an optimum manner through the apparatus is not only

determined by the angular lay-out of the rotors, but also by the "effective width" or distance between the rotors 4 to 7. Hence, feature (iii) taken per se comprises a very limited part of the technical information which can be put into practice only by concurrently paying attention to other structural features of the apparatus.

The patentee argued in this connection that it is within the skilled worker's competence to determine the optimal ("effective") distance between the different rotors so that a high quality mineral wool comprising minimal amounts of shot is obtained. This argument being accepted as granted implies that also the choice of the other parameters such as the angular layout or "sum of angles" which equally determine the optimal path of the melt lies within the routine of the skilled practitioner. Given that in the present case the simultaneous optimisation of the angular adjustment of and the distance between the rotors leads to a compromise lying within the discretion of a skilled person, feature (iii) does not add an inventive step to the subject-matter of claim 1. Therefore, claim 1 of the first auxiliary request is also not allowable.

6. *Second auxiliary request*

Claim 1 of the second auxiliary request is directed to a process for making mineral wool. Of the various documents cited on appeal, document D12 is prima facie highly relevant to the claimed process.

Given this situation, substantive examination as to patentability needs to be resumed on a new basis and the problem to be solved by the claimed process determined in the light of new citation D12 in combination with the documents already considered.

Following also the respondent's corresponding request, the Board finds it, therefore, appropriate in accordance with Article 111(1) EPC and in order to grant the respondent (patentee) two levels of jurisdiction to remit the case to the first instance for further prosecution.

### 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 for further prosecution on the basis of the process claims according to the second auxiliary request submitted during the oral proceedings.

The Registrar:

  
V. Commare

The Chairman:

  
W. D. Weiß

R.R.