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D E C I S I O N
of 4 April 2001

Case Number: T 1055/98 - 3.3.5

Application Number: 94904238.6

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Language of the proceedings: EN

Title of invention:
Saline soluble inorganic fibres

Patentee:
THE MORGAN CRUCIBLE COMPANY PLC

Opponent:
RATH Spezialkeramik GmbH
ROCKWOOL International A/S

Headword:
Fibres/MORGAN

Relevant legal provisions:
EPC Art. 123(2), 84, 56, 100b
EPC R. 29(6)

Keyword:
"Ranges formed from values taken from the examples (amendments not allowable)"
"Sufficiency of disclosure (yes, no undue burden of experimentation)"

Decisions cited:
T 0226/85, T 0014/83, T 0301/87, T 0472/88, T 0127/85

Catchword:
-



Case Number: T 1055/98 - 3.3.5

D E C I S I O N
of the Technical Board of Appeal 3.3.5
of 4 April 2001

Appellant:
(Proprietor of the patent) THE MORGAN CRUCIBLE COMPANY PLC
Morgan House
Madeira Walk
Windsor
Berkshire SL4 1EP (GB)

Representative:
Boff, James Charles
Phillips & Leigh
5 Pemberton Row
London EC4A 3BA (GB)

Respondents:
(Opponent I) RATH Spezialkeramik GmbH
Ossietzkystrasse 37/38
D-01662 Meißen (DE)

Representative:
Albrecht, Ralf, Dipl.-Ing.
Paul & Albrecht
Patentanwaltssozietät
Fichtestrasse 18
D-41464 Neuss (DE)

(Opponent II) ROCKWOOL International A/S
Hovedgaden 584
DK-2640 Hedehusene (DK)

Representative:
Lawrence, Peter Robin Broughton
GILL JENNINGS & EVERY
Broadgate House
7 Eldon Street
London EC2M 7LH (GB)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 22 October 1998
revoking European patent No. 0 679 145 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: R. K. Spangenberg
Members: M. M. Eberhard
M. B. Günzel

Summary of Facts and Submissions

- I. European patent No. 679 145 based on application No. 94 904 238.6 and claiming the priority of WOPCT/GB93/00085 and MX 9300200 both filed on 15 January 1993 (hereinafter P1 and P2 respectively) and of GB 9314236 filed on 9 July 1993 (hereinafter P3) was granted on the basis of 19 claims.
- II. Respondents I and II (opponents I and II) filed a notice of opposition requesting revocation of the patent on the grounds of extension of the subject-matter beyond the content of the application as filed, insufficiency of disclosure, lack of novelty and inventive step. In support of their arguments they relied inter alia on WO 93/15028 (D1) and WO 89/12032 (D3).
- III. The opposition division revoked the patent. The decision was based on the claims as granted, as the main request, and on seven sets of amended claims filed on 21 August 1998, as auxiliary requests.

The opposition division held that the amendments in claims 7, 8, 11 and 12 of the main request and in the corresponding claims of the 1st, 4th and 5th auxiliary requests did not fulfil the requirements of Article 123(2) EPC. The limit values for the ranges stated in the said claims were partly taken from fibres which were not successful and thus did not belong to the invention. It further took the view that the 2nd, 3rd, 6th and 7th auxiliary requests did not meet the requirement of sufficiency of disclosure. The patent did not give an indication as to how to obtain fibres of the same chemical composition as in example 84 of D3 but meeting the shrinkage requirement.

IV. The appellant (proprietor of the patent) lodged an appeal against this decision and submitted nine sets of amended claims, as a main request and eight auxiliary requests, with the statement of grounds of appeal. By a letter dated 15 November 1999 respondent II withdrew his opposition. Oral proceedings were held on 3 April 2001. At the oral proceedings, the appellant submitted five sets of amended claims as a main request and 1st to 4th auxiliary requests, in replacement of all the previous requests on file. Claim 1 of the main request reads as follows:

"1. Use as insulation for applications requiring resistance to a temperature of 1260°C of a saline soluble refractory fibre for which a vacuum cast preform of the fibre using 75g of fibre in 500cm³ of 0.2% starch solution into a 120x65mm tool has a shrinkage of 3.5% or less, as measured by the method of the description, when exposed to 1260°C for 24 hours and comprising CaO, SiO₂, MgO, optionally ZrO₂, optionally less than 0.75mol% Al₂O₃, any incidental impurities amounting to less than 2mol% in total of which TiO₂ is less than 1.25mol%, in which the amount of CaO is less than the sum of the amount of MgO and twice the amount of ZrO₂ and in which the SiO₂ excess (defined as the amount of SiO₂ calculated as remaining after the above named constituents are crystallised as silicates) exceeds 21.8mol%."

Dependent claims 6 and 8 are directed respectively to the use of fibres in which MgO (in mol%) > CaO (ie excess MgO fibres) and MgO (in mol%) < CaO (ie excess ZrO₂ fibres). Dependent claims 7 and 9 state ranges for the amounts of CaO, MgO, ZrO₂ and SiO₂. Claim 7 reads as follows:

"7. Use as claimed in claim 6 in which the fibres comprises approximately (in mol%):

CaO 9.12-19.05

MgO 13.92-22.31

ZrO₂ 0-9.32

SiO₂ 60.99-67.70"

Claim 1 of the first auxiliary request is identical to claim 1 of the main request. Dependent claims 7 and 9 contain no ranges but a list of specific compositions taken from Table 2 of the patent in suit.

V. The appellant put forward inter alia the following arguments in connection with the present use claims:

Claims 7 and 9 of the main request met the requirement of Article 123(2) EPC. In the two separate regions (excess MgO and excess ZrO₂) the skilled person would have derived from Table 2 an envelope of all components of the fibres which had been fully tested. It would have been natural for the skilled person to derive for each of the principal components of the fibres a range encompassing the fibres that had been shown to meet the shrinkage requirement. The claims encompassed all the fibres which met the shrinkage criterion and few of those that did not. The low levels of Al₂O₃ and incidental impurities were stated in claim 1 and claims 7 and 9 further gave the amounts of the major components SiO₂, MgO, CaO and ZrO₂. The amendments in claim 1 of the main and 1st auxiliary requests were directly derivable from the application as filed. Regarding claims 7 and 9 of the 1st auxiliary request, the column "others" disclosed in Table 2 was not introduced into the claims since it contained no technical information of relevance.

Concerning sufficiency of disclosure, the appellant denied that there was any undue burden of experimentation. The results of Table 2 of the specification showed that in both the excess MgO and excess ZrO₂ regions the preponderance of success to failure exceeded 2 to 1 and the ratio of proven successes to unexplained failures exceeded 5 to 1. The patent gave a large number of starting compositions meeting the shrinkage criterion and advised that the impurity levels should be kept as low as possible. It gave guidance by explaining particular failures and also gave examples which might be promising, as well as a simple shrinkage test to screen for suitability as high refractory insulation.

The shrinkage test was sufficiently described and led to reproducible results. The specification disclosed the amounts of starch and fibres to be used. The relative amount of starch was an important parameter since it had an influence on the structure of the preform. Although variations in density had some effect on the shrinkage, this effect was not large as shown by the appellant's shrinkage tests on commercial blankets. The skilled person could have dealt with any density variation by a process of calibration based on the shrinkage results disclosed in the description.

D1 was published after the filing date of the priority document P3. As claim 1 of the main request was entitled to the priority of P3, D1 did not belong to the state of the art as defined in Article 54(2). If none of the priority dates could be accorded, then D1 would have been available as prior art document; however, the claimed use would have involved an inventive step over the teaching of D1. This document gave no indication which fibre would have been useful as insulation at 1260°C and which not. It was referred to a demand for fibres having a maximum service

temperature of 900°C to 1200°C and Table 5 showed that the fibres disclosed therein satisfied this demand. Fibres A2-10 and A2-13 of Table 9 were not a natural place for the skilled person to start with taking into account their shrinkage values. The skilled person would have concentrated on the fibres of Table 5 rather than those of Table 9. The claimed use was also not obvious over the disclosure of D3. The skilled person would not have tested the fibres disclosed in claim 52 thereof since there was no exemplified fibre falling within the ranges of this claim. Furthermore, the fibres of claim 52 of D1 could not possibly fulfil the requirement of claim 1 concerning the CaO and MgO amounts. Claim 52 pointed the skilled person towards high CaO content fibres. The skilled person would have had no reason to look at fibres 82 or 84 of D3. The fact that a fibre passed the two-hour fire test gave no indication at all as to whether it would stand the shrinkage test in which the fibre was exposed to the high temperature for 24 hours.

VI. The arguments of respondent I can be summarised as follows:

Claims 7 and 9 of the main request did not meet the requirement of Article 123(2) EPC. It was not allowable to create the claimed compositional ranges from single points. The patent contained a large number of examples, however in view of the fibres which failed to meet the shrinkage criterion it was not directly derivable which ranges could be combined together and in which form. Furthermore, the skilled person would not have disregarded the values given in Table 2 for the remaining components. The amendments in claim 1 of both the main and the 1st auxiliary requests were not allowable since it was not derivable from the original description that the fibres could be used as insulation for applications requiring resistance to 1260°C.

Claim 1 further lacked clarity in that the shrinkage test was not clearly defined. Essential features having an influence on the shrinkage results were missing. Moreover the phrase "using 75g of fibre in 500cm³ of 0.2% starch solution into 120x65mm tool" was not clear. The reference to the description for the measurement of the shrinkage was not in agreement with Rule 29(6) EPC.

Concerning the issue of sufficiency of disclosure, the respondent referred in particular to T 226/85 (OJ 1988, 336) and T 14/83 (OJ 1984, 105) and argued that according to the case law a reasonable amount of trial and error was permissible but the patent had to contain adequate instructions which would lead the skilled person necessarily and directly towards success after the evaluation of initial failures. This was not the case in the patent in suit. Only a small part of the examples having the claimed composition exhibited the shrinkage characteristics and positive results were rather incidental. Furthermore, the patent did not contain sufficient data concerning the preparation of the vacuum cast preform so that the skilled person could not check whether or not the fibres fulfilled the shrinkage criterion. It could be derived from the respondent's experimental report A1 dated 20.05.1999 that the shrinkage characteristics strongly depended on the density of the vacuum cast preform. In the absence of density data and of other essential features for the preparation of the preform in the patent, the amount of experimentation which the skilled person had to perform was increased and the failure rate of the unpromising "trial and error" approach was thus still higher.

Claim 1 of the main request was not entitled to the priority of P1 or P2 since the use of the fibres as insulation at a temperature of 1260°C was not disclosed therein. The priority claim based on P3 was not valid since P3 disclosed the relation $\text{CaO} < \text{MgO} + 2\text{ZrO}_2$ only in

combination with a CaO content of less than 24mol%. The effective date of the patent was thus its filing date and D1 belonged to the state of the art for the assessment of inventive step. D1 was concerned with the same problem as the patent in suit. In view of the shrinkage test at 1000°C in Table 9 of D1, the skilled person would have picked out the fibres A2-10 and A2-13 and tested them to check their behaviour at higher temperatures. Doing so, he would have arrived in an obvious manner at the conclusion that these fibres were usable at 1260°C. The shrinkage test in D1 was practically identical to that used in the patent in suit. The claimed use lacked also inventive step over the teaching of D3 which addressed the problem of providing saline soluble fibres suitable for use at high temperatures. Claim 52 of D3 disclosed fibres having a continuous service temperature above 815°C and containing the same main components as the fibres of the patent. The skilled person would have tried to modify the MgO and CaO contents of the fibres to find further refractory fibres. He would thereby have come to the fibres 82 and 84 of D3. The fire test was not performed on these fibres, but as fibre 84 and fibre 81 had the same solubility values and both fibres were relatively pure, the skilled person would also have expected fibre 84 to pass the fire test. Passing this test was an indication that the fibres would meet the shrinkage test at high temperature for 24 hours.

- VII. The appellant requested, as a main request, that the decision under appeal be set aside and that the patent be maintained on the basis of the main request filed during the oral proceedings, or as auxiliary requests, on the basis of the claims of any of the 1st to 4th auxiliary requests, taken in their numerical order. Respondent I requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

Main request: claim 7

2. Claim 7 does not meet the requirements of Article 123(2) EPC for the following reasons:

The ranges (in mol%) 9.12-19.05% CaO, 13.92-22.31% MgO, 0-9.32% ZrO₂ and 60.99-67.70% SiO₂ indicated in claim 7 for "the excess MgO" fibres have been formed by the appellant taking values disclosed in various examples of Table 2 of the original application as upper and lower limits for each oxide (see compositions B6, D7, A2-10, A2-13, BZ-560, BZ-60 and BZ-8 between lines C and D of Table 2). Ranges for the CaO, MgO, SiO₂ and ZrO₂ contents are, however, not disclosed in the application as originally filed. Therefore, the ranges now claimed do not represent a limitation of broader ranges disclosed in the application for fibres meeting the shrinkage requirement stated in claim 1.

Furthermore, Table 2 shows that the formed ranges encompass a number of fibre compositions which do not fulfil the shrinkage criterion stated in claim 1. 40 fibres having a composition within the claimed ranges and whose shrinkage characteristics have been tested are disclosed between lines C and D of Table 2. Of these 40 fibres, 28 meet the shrinkage requirement, 12 do not. The fibres which do not satisfy the shrinkage criterion have CaO, MgO, ZrO₂ and SiO₂ contents not necessarily located close to the limits of the ranges. In the board's judgement, if the skilled person has to form ranges from the list of examples in Table 2, he would not define ranges encompassing to a considerable extent fibres which fail to meet the shrinkage criterion but would try to find a combination of ranges

excluding those fibres which fail. In these circumstances, the board is not convinced that the skilled person would directly and unambiguously derive from Table 2 or from the original application the claimed ranges which include a number of fibres not meeting the shrinkage criterion. Furthermore, the CaO, MgO, SiO₂ and ZrO₂ contents disclosed in the examples between lines C and D of Table 2 are associated with contents of Al₂O₃ and TiO₂, the upper limits of which are lower than the values of 0.75 mol% and 1.25mol% stated in claim 1. In particular in the case of TiO₂, the upper limit of 0.73 mol% (fibre D2 which meets the shrinkage criterion) is well below the limit of 1.25 mol%. It is not directly and unambiguously derivable from the original application that the ranges defined in claim 7 and formed from the examples of Table 2 can be associated with higher TiO₂ contents than those disclosed in the said Table. As claim 7 does not comply with the provisions of Article 123(2)EPC, the main request must be rejected.

First auxiliary request

3. The amendments in the claims of this request meet the requirements of Article 123(2) and (3) EPC. Claim 1 is based on a combination of original claims 1, 6 and 9 with features taken from the description as originally filed. In particular, the use of the fibres as insulation for applications requiring resistance to a temperature of 1260°C is directly and unambiguously derivable from the passage including the last paragraph of page 3 and the first three paragraphs of page 4 where it is disclosed that the maximum service temperature of known fibres, when used as refractory insulation, is up to 815°C and 1050°C in the case of the commercial fibres SUPERWOOL and that the fibres according to the patent in suit are usable at temperatures to and beyond 1260°C. The use of inorganic

fibrous materials as thermal insulation is further mentioned in the general statement on page 1 of the application. The additional features concerning the preparation of the vacuum cast preform have a support on page 10, 5th paragraph, of the application as filed. The features of dependent claims 2 to 6 are disclosed in original claims 2 to 5 and 7 respectively and those of claim 8 on page 5, third paragraph, of the original application. The specific compositions stated in claims 7 and 9 are disclosed in Table 2 (see pages 17 and 18 for the excess MgO fibres, respectively compositions BZ-60, BZ-54, BZ-437, BZ-560C, BZ-61, BZ-440, BZ-58, BZ-560, BZ-56, BZ-20, BZ-63, BZ-441, B11, A2-13, BZ-610, D7, B7, BZ-8, BZ-59, A2-10, BZ-560A, D9, B10, BZ-4150, B17, B6, D2, BZ-560E; and page 19 for the excess ZrO₂ compositions BZ-52, BZ-48, BZ-36, BZ-7, BZ-435, BZ-410, BZ-4, BZ-438, BZ-46, BZ-419, BZ-414, BZ-404, BZ-420, BZ-426, BZ-19, BZ-433, BZ-415, BZ-62, BZ-400, BZ-403, BZ-44, BZ-431, BZ-401, BZ-413, BZ-38, BZ-409, BZ-50, BZ-53, BZ-408). Table 2 further mentions amounts of components varying from 0 to 0.9 wt% in the column headed "Others". These amounts are not reported in claims 7 and 9. It is directly derivable from page 8, 8th paragraph, that the "Others" are in fact the incidental impurities other than TiO₂. However, in the absence of further information as to which impurities are present in the said amounts of 0-0.9 wt%, the technical information given in this column is of little relevance, as pointed out by the appellant and not contested by the respondent, all the more so that the sum of the components reported in claims 7 and 9 for each composition is at least 98.4 and up to 100.4wt%. In these circumstances the omission of these data in claims 7 and 9 cannot be considered as contravening the requirement of Article 123(2) EPC. The scope of protection conferred by claim 1 of the first auxiliary request is clearly restricted with respect to that of the granted claims.

4. The reference in claim 1 to the description in respect of the method of measuring the shrinkage is considered to comply with the provisions of Rule 29(6) EPC. Taking into account the length of the method of measurement disclosed at page 6 of the patent in suit and the way it is described, the board considers that its inclusion in claim 1 would negatively affect the conciseness thereof and thus that the present case represents an allowable exception.

5. The respondent argued at the oral proceedings that the wording of claim 1 was rendered unclear by the introduction of the phrase "using 75g of fibre in 500cm³ of 0.2 % starch solution into a 120x65mm tool". The appellant's representative, who is a native English speaker, contested these arguments and indicated that the wording of claim 1 was clear and had exactly the same meaning as the wording used on page 6, lines 19-20, of the patent where it is said that the method of measurement of the shrinkage "comprises the manufacture of vacuum cast preforms, using 75g of fibre in 500cm³ of 0.2% starch solution, into 120x65mm tool". The wording in the description was not objected to by the respondent. The board sees no reason not to accept the appellant's arguments since, although the wording of claim 1 might be open to improvement, the present formulation does not prevent the skilled person from understanding the relevant technical information concerning the manufacture of the vacuum cast preform.

6. The respondent raised a further objection under Article 84 EPC against claim 1, namely that features which were essential for the manufacture of the vacuum cast preform, such as the density of the preform, the physical characteristics of the fibres, the mixing period, the mixing rate and the casting conditions, were missing in claim 1. The board observes in this respect that granted claim 1 already contains the

feature that "a vacuum cast preform of the fibre has a shrinkage of 3.5% or less when exposed to 1260°C for 24 hours" without indicating at all how the vacuum cast preform is manufactured. Thus, the objection under Article 84 also applies to the granted claims and was indeed already raised by the respondent against the granted claims. Lack of clarity or support pursuant to Article 84 EPC are, however, no grounds of opposition. According to the case law of the boards, in the case where claims have been amended during the opposition proceedings, the opposition division and the board have in principle the power to deal with these issues only if they arise out of the amendments made to the claims (see decisions T 301/87, OJ EPO 1990, 335; T 472/88 of 10 October 1990, point 2 of the reasons). Such objections may, however, be relevant to opposition proceedings insofar as they may influence the decisions on issues under Article 100 EPC, in particular sufficiency of disclosure, novelty and inventive step. In such cases these objections need not be investigated further than is necessary to enable assessment of the issue already at hand (see T 127/85, OJ EPO 1989, 271). The board has no reason to deviate from this case law. In the present case the appellant has introduced additional features concerning the manufacture of the vacuum cast preform and the shrinkage test into claim 1 in reply to the respondent's objection. From the point of view of Article 84, claim 1 has been improved by the said amendments in that it now contains some features concerning the manufacture of the vacuum cast preform on which the shrinkage is measured. The respondent's objection that claim 1 does not contain all the essential features of the manufacture does not arise out of the amendments made to the claim. Therefore, this objection will be investigated below in the paragraphs concerning sufficiency of disclosure, novelty and inventive step only to the extent necessary to enable assessment of these issues.

7. The respondent's arguments that the patent does not meet the requirement of sufficiency of disclosure cannot be accepted by the board for the following reasons. Concerning the excess MgO fibres, the patent contains 28 examples of fibres having compositions falling within the ranges stated in claim 1 and meeting the shrinkage criterion. As regards the excess ZrO₂ fibres, the patent discloses 29 examples of fibres having the desired low shrinkage characteristics and falling within the claimed ranges of composition. The respondent has not shown that the skilled person was not able to reproduce the exemplified fibres that meet the shrinkage criterion. His arguments that the patent did not contain sufficient data concerning the preparation of the vacuum cast preform so that the skilled person could not check whether or not the fibres exhibit the desired shrinkage are not convincing. The patent discloses the manufacture of the vacuum cast preform into 120x65mm tool, using 75g of fibres in 500 cm³ of 0.2% starch solution. Information such as the mixing period, the mixing rate, the casting conditions and the density of the preform are indeed not indicated in the patent as pointed out by the respondent. However, as the manufacture of vacuum cast preforms was a well known technique before the priority date, the board considers that the skilled person would have been able to prepare a vacuum cast preform from the fibres exemplified in the patent in suit following the information given therein. The skilled person was aware of the fact that he had to produce a homogeneous suspension of fibres and a homogeneous vacuum cast preform and, thus, he would have selected the mixing and casting conditions accordingly. Although the burden of proof rests on the respondent, he has provided no evidence that the skilled person would not have been able to obtain a shrinkage value similar to that indicated in any example of the patent by reproducing fibres of this example and measuring their shrinkage on

a vacuum cast preform, both the manufacture of the preform and the shrinkage test being performed as indicated in the patent in suit. Even if the shrinkage value firstly obtained had been different, for example as a result of different casting conditions leading to a different density as mentioned on page 6, lines 26 to 27, of the patent, then the skilled person could have dealt with this density variation by a calibration process as pointed out by the appellant. Such a calibration process lies within the competence of the skilled person and the respondent has not shown that it would require a considerable amount of experimentation.

Referring to the case law, in particular to decisions T 226/85 (OJ 1988, 336) and T 14/83 (OJ 1984, 105), the respondent argued that the principles set out therein were not fulfilled by the patent. He contended that in the present case it would have been an undue burden of experimentation to find fibres other than those exemplified but which have both a composition and a shrinkage within the scope of claim 1. These arguments were based on the rate of failures obtained in the examples of the patent with different fibre compositions. In this respect the board observes that, in the region of MgO excess fibres, the patent contains 41 examples of fibres having compositions within the scope of claim 1 and whose shrinkage at 1260°C was determined. Out of these 41 examples, 28 fibres fulfil the shrinkage criterion and 13 fail. In the region of the excess ZrO₂ fibres, 32 examples of compositions falling within the claimed ranges have been tested. 29 fibres have the desired low shrinkage characteristics and 3 fail. As pointed out by the appellant the preponderance of success to failure exceeds 2 to 1 in both excess MgO and ZrO₂ regions. Furthermore, the patent specification gives an explanation as to why some fibres have failed on page 5, lines 37 to 54. Taking into account these explanations, the ratio of

proven successes to unexplained failures exceeds 5 to 1 for the excess MgO fibres and amounts to 29:1 for the excess ZrO₂ fibres. By explaining some failures, the patent specification gives guidance to the skilled person as to how to avoid failures when trying to produce a fibre not exemplified in the patent and meeting the shrinkage criterion. The patent advises in particular that impurity levels should be kept as low as possible (page 4, lines 49 to 50; page 8, line 4). It also discloses that fibres containing high levels of ZrO₂ can tolerate higher levels of Na₂O or Fe₂O₃ (incidental impurities) than fibres with low levels of ZrO₂ (see page 5, lines 46 to 47 and page 6, lines 32 to 34). Furthermore, the skilled person also has guidance in the form of sets of comparable compositions which instruct him on the effect of impurities. In these circumstances, the board is not convinced that it would represent an undue burden of experimentation to find fibres that are usable as insulation at 1260°C other than the exemplified ones. It follows from the above that the requirement of sufficiency of disclosure set out in Article 100(b) and 83 EPC cannot be considered not to be met.

8. It was no longer disputed at the oral proceedings that the use as defined in claim 1 of this request is novel with respect to the cited documents. Concerning D3, the board observes that the composition of fibre 84 (see page 37) indeed falls within the scope of claim 1. However, the shrinkage characteristics of this fibre are not indicated in D3, nor is it disclosed in this document that the fibres may be used as insulation for applications requiring resistance to a temperature of 1260°C.

9. The patent claims the priority date of 15.01.1993 from P2 and P1 (the PCT application corresponding to D1) and the priority date of 09.07.1993 from P3. The respondent

has disputed that claim 1 of this request is entitled to these priority dates. However, the question whether or not the priority claims are valid need not be decided since even if it were assumed in favour of the respondent that they are not valid and thus that D1 forms part of the state of the art according to Article 54(2) EPC, the use as defined in claim 1 would be considered to involve an inventive step for the reasons given below.

10. Assuming for the sake of argument that D1 belongs to the state of the art as defined in Article 54(2), then D1 would represent the closest prior art. D1 discloses saline soluble fibres having a shrinkage of less than 3.5% when exposed to 1000°C for 24 hours and/or 800°C for 24 hours. The fibres of D1 have a composition comprising (in weight %) $\text{SiO}_2 > 58\%$ for $\text{MgO} \leq 10\%$ and $\text{SiO}_2 > 58\% + 0.5(\% \text{MgO} - 10)$ for $\text{MgO} \geq 10\%$; $\text{CaO } 0\% - 42\%$; $\text{MgO } 0\% - 31.33\%$; $\text{Al}_2\text{O}_3, 0\% - <3.97\%$. These fibres are essentially free of fluxing components such as alkali metal oxides and boron oxide. The fibres can be used as refractory insulation at high temperatures. A maximum service temperature of 1050°C is disclosed in this document for fibres SW-A1, SW-A2, SW-B1, SW-B2. These fibres exhibit a linear shrinkage at the maximum service temperature of less than 3.5% and have the following compositions in weight %:

	SW-A1	SW-A2	SW-B1	SW-B2
Al_2O_3	1.1	0.8	2.3	1.3
SiO_2	63.7	60.8	65.2	66.9
CaO	20.5	21.4	26.8	27.5
MgO	15.2	15.4	5.7	5.2

(see page 46, claim 7; page 3, 5th and 6th paragraphs; page 5, lines 22 to 23; page 6, 4th paragraph; page 10, Table 1; page 17, Table 5 and last paragraph).

10.1 Starting from this prior art the technical problem underlying the claimed use can be seen in the provision of saline soluble refractory fibres which are suitable for use as insulation at higher temperatures.

The patent in suit proposes solving this problem by the combination of features as defined in claim 1. The claimed subject-matter differs from the disclosure of D1 in that the fibres are used as insulation for applications requiring resistance to a temperature of 1260°C. It further differs from the fibres having a maximum service temperature of 1050°C by the composition of the fibres since SW-B1 and SW-B2 are excess CaO fibres and SW-A1 and SW-A2 are excess MgO fibres having a SiO₂ excess well below the value of 21.8 mol%.

Taking into account the statements on page 4, lines 15 to 16, and page 7, lines 48 to 54, of the patent and the shrinkage and solubility values reported in Tables 2 and 3 for both the excess MgO fibres and the excess ZrO₂ fibres, it is credible that the said technical problem has actually been solved by the claimed subject-matter. This was not disputed by the respondent.

10.2 D1 discloses that there is a demand for physiologically soluble fibres having a service temperature above 900°C and for saline soluble needled fibre blanket formed from inexpensive materials and having a maximum service temperature in the range of 900°C to 1200°C. The service temperature for refractory insulation is defined in D1 as that temperature at which the fibre shows acceptable shrinkage (maximum of 5% linear shrinkage after exposure to temperature for 24 hours) and at which the fibre does not appreciably suffer through excessive sintering or softening (see page 3, 6th and 7th paragraphs; page 6, 4th paragraph). The

highest value for the maximum service temperature disclosed in D1 is 1050°C for fibres SW-A1, SW-A2, SW-B1 and SW-B2 (see Table 5 on page 17). These fibres exhibit a linear shrinkage of 1.04%, 1.3%, 0.51% and 0.6% respectively when exposed for 24 hours at temperatures of 1000°C. The shrinkage values of SW-A1, SW-A2 and SW-B2 at 1100°C for 24 hours are respectively 0.71%, 1.8% and 0.73%. Table 9 of D1 further discloses a large number of fibre compositions and their shrinkage at 800°C and 1000°C. The respondent's arguments that the skilled person would have picked out fibres A2-10 and A2-13 and tested them for their behaviour at temperatures higher than 1000°C cannot be followed by the board for the following reasons. Fibre A2-10 has shrinkage characteristics at 1000°C and 800°C of 2.2% and 1.9% respectively, ie values which are higher than those indicated in Table 5 for fibres tested at 1000°C and 1100°C and which are said to have a maximum service temperature of 1050°C. As regards fibre A2-13, its shrinkage at 800°C is not given and its shrinkage at 1000°C is 1.6%, ie also higher than the highest shrinkage value at 1000°C given in Table 5 for fibres having a maximum service temperature of 1050°C. In these circumstances, the skilled person faced with the problem stated above would not have been encouraged to test these two fibres since he could not have expected them to have a better resistance to high temperatures than the fibres of Table 5. In the board's view, if the skilled person had contemplated testing fibres of Table 9 to determine whether or not they have a higher maximum service temperature than those of Table 5, he would have selected from the numerous fibres listed in Table 9 those having the best shrinkage characteristics and, in any case, a shrinkage at 1000°C substantially lower than that of the said fibres of Table 5. This is not the case for fibres A2-10 and A2-13 as already indicated above. The fibre compositions B3-18, B3-16, B3-27, B3-31, B3-19, B3-17,

B3-15, 719, 718, 721, B3-30, 723, B3-13, 725, B3-11, B3-1, B3-29 for example might have been considered by the skilled person as being worthy of testing in view of their shrinkage values. Assuming that the skilled person would have tested these fibres, he would not have arrived at the claimed subject-matter since they do not meet the requirement stated in claim 1 for the fibre composition. They are all excess CaO fibres which are excluded from claim 1. Furthermore, D1 does not contain any information which would have suggested that excess MgO fibres or excess ZrO₂ fibres having a SiO₂ excess >21.8mol% might be used as insulation for applications requiring resistance to a temperature of 1260°C. For these reasons, the board considers that the appellant's line of arguments is based on an ex post-facto approach.

- 10.3 D3 is concerned with the problem of providing low cost, friendly feeling low bulk density fibres which are soluble in physiological saline solutions and have good fire resistance properties as measured by their ability to pass the ASTM E-119 two-hour fire test. Fibres having high continuous service temperatures would also be advantageous (see page 4, last paragraph). Continuous service temperatures varying from 721°C to 816°C are given in Table 6 for fibres containing no alumina. D3 further discloses inorganic fibres having a silicon extraction of greater than about 0.02 wt% Si/day in a physiological saline solution, which exhibit a continuous service temperature above about 816°C. These fibres have a composition consisting essentially of about 0.06-1.5 wt% of oxides selected from the group Al₂O₃, ZrO₂, TiO₂, B₂O₃, iron oxides and mixtures thereof; 60-70 wt% SiO₂; 0-1 MgO; and the remainder consisting essentially of CaO, the total being 100 wt% (see page 61, claim 52). In view of this teaching, the skilled person confronted with the problem stated above would have contemplated testing

the fibres disclosed in claim 52 in order to determine their shrinkage and their continuous service temperature in the range above 816°C. As the teaching of claim 52 is associated with relatively narrow compositional ranges which are illustrated by several examples in the description, the board is not convinced by the appellant's arguments that the skilled person would not have tested the fibres of claim 52. However, even if he had tested the fibres he would not have arrived at the claimed subject-matter since the fibres of claim 52 of D3 have a composition not falling within the definition of claim 1, the CaO content of these fibres being higher than the sum of the MgO content and twice the amount of ZrO₂. There is no further teaching in D3 suggesting that fibres having a composition outside that given in claim 52 might have a continuous service temperature above 816°C. In these circumstances the skilled person would have had no reason to modify the MgO and CaO contents of these fibres or to determine the shrinkage characteristics of fibres 84 and 82 disclosed on page 37 of D3. As their compositions fall outside the ranges given in claim 52 these fibres could not be expected to have a continuous service temperature above 816°C, let alone a maximum service temperature higher than the value of 1050°C disclosed in Table 5 of D1. Table 4 discloses the results of the two-hour ASTM- E-119 fire test; however it is not even indicated in this Table whether or not fibres 82 and 84 pass this test. Furthermore, as pointed out by the appellant, the rising temperature profile used in this two-hour fire test is such that the fibres are exposed to high temperatures of 1000 to 1010°C only for a very short period and, therefore, this test gives no guidance as to whether or not the fibre will withstand such high temperatures for 24 hours. The respondent's affirmation that passing the two-hour fire test was an indication that the fibres would meet the shrinkage criterion when exposed at the

same high temperature for 24 hours is not convincing in the absence of any substantiation. In these circumstances it is irrelevant whether or not fibre 84 would pass the two-hour fire test like fibre 81. The question whether or not the respondent's report A1 shows that fibre 84 has a shrinkage at 1260°C within the scope of claim 1 when measured by the method of the patent has also no influence on the issue of inventive step since D3 is silent about the shrinkage of fibre 84 at such a high temperature. Therefore, there was no reason to obtain the opinion of a neutral expert which was requested by the respondent in connection with the product claims and not maintained with respect to the present use claims.

- 10.4 It follows from the above that the subject-matter of claim 1 meets the requirement of inventive step with respect to the disclosure of D1 and D3. At the appeal stage, the respondent no longer relied on the remaining documents cited during the opposition proceedings. The board is also of the opinion that these documents contain no further information which, in combination with the teaching of D1 and D3, would point towards the claimed use.
- 10.5 It follows from the above that the subject-matter of claim 1 of the 1st auxiliary request meets the requirement of inventive step set out in Articles 52(1) and 54 EPC.
11. Claim 1 being allowable, the same applies to dependent claims 2 to 9 whose patentability is supported by that of claim 1.

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 with the claims of the first auxiliary request filed during the oral proceedings before the board and a description to be adapted.

The Registrar:

The Chairman:



G. Rauh



R. Spangenberg