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D E C I S I O N
of 21 October 2005

Case Number: T 0409/03 - 3.3.05

Application Number: 95924235.5

Publication Number: 0767762

IPC: C03C 1/02

Language of the proceedings: EN

Title of invention:
Production of mineral fibres

Patentee:
Rockwool International A/S

Opponent:
Paroc Group Oy Ab

Headword:
Briquettes/ROCKWOOL

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes; confirmed)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0409/03 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 21 October 2005

Appellant: (Opponent)	Paroc Group Oy Ab Neilikkatie 17 FI-01300 Vantaa (FI)
Representative:	Grew, Eva Regina Oy Jalo Ant-Wuorinen Ab Iso Roobertinkatu 4-6-A FI-00120 Helsinki (FI)
Respondent: (Proprietor of the patent)	Rockwool International A/S Hovedgaden 501 DK-2640 Hedehusene (DK)
Representative:	Lawrence, Peter Robin Broughton GILL JENNINGS & EVERY Broadgate House 7 Eldon Street London EC2M 7LH (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted 20 February 2003 concerning maintenance of the European patent No. 0767762 in amended form.**

Composition of the Board:

Chairman: M. Eberhard
Members: J.-M. Schwaller
S. Hoffmann

Summary of Facts and Submissions

I. The appeal is directed against the opposition division's interlocutory decision posted on 20 February 2003 according to which, account being taken of the amendments made by the patent proprietor during the opposition proceedings, European patent No. 0767762 and the invention to which it relates were found to meet the requirements of the EPC. The decision was based on the set of claims according to the main request submitted with the letter of 12 November 2002. Claim 1 thereof reads as follows:

"1. A method of making man made vitreous fibres comprising forming compression moulded briquettes of particulate inorganic material bonded by a binder, forming a melt by melting in a furnace a mineral charge comprising a self supporting column of solid coarse mineral material comprising the briquettes, and forming vitreous fibres from the melt, characterised in that the compression moulded briquettes are made by mixing the particulate inorganic material, burnt lime, fibres, and molasses in an amount of 1 to 15% (by weight based on the total weight of the mixture) in the presence of moisture and thereby causing an exothermic reaction and an increase in the temperature of the mixture, allowing the mixture to stiffen, then transferring the stiffened mix to compression moulding apparatus, and forming the briquettes by compression moulding the mix in the compression moulding apparatus."

II. The following prior art documents were *inter alia* relied upon during the opposition proceedings:

D1 = US-A-4720295

D2 = EP-A-467739

D8 = GB-A-2181449

D9 = Ullmann's Encyclopedia of Industrial Chemistry, 4th edit., 1990, vol. A15, pp. 317, 318 and 323.

III. The opposition division held that the claimed process differed from the closest prior art D1 in that the binder comprised hydrated lime instead of burnt lime. It considered that D8 did not teach the interchangeability of hydrated lime and burnt lime for reaching the same effect in a cupola furnace for the production of glass fibres as D8 related to binding carbonaceous materials. The skilled man, faced with the problem of improving the stability of briquettes for cupola furnaces would not have taken into consideration the teachings of D8 and D1, as D8 related to a totally different problem (the friability of briquettes made of carbonaceous fuel particles bonded with a molasses binder) and as neither D1 nor D8 disclosed or suggested the combination of fibres + burnt lime + molasses. There was no hint either in D1 or in D8 that the combination of burnt lime + molasses would result in a rapid stiffening before transferring the mixture to compression moulding to form briquettes.

IV. With the grounds of appeal, the appellant (opponent) filed a new prior art, EP-A-0155439 (D10), and contended that the subject-matter of claim 1 lacked an inventive step over D1, taken in combination with the teachings of D8 and D10 (or D2).

V. The respondent (patentee) filed two sets of claims as 1st and 2nd auxiliary requests with a letter dated 19 December 2003, requested to disregard D10 and argued in favour of the inventiveness of the subject-matter claimed. He also filed a plot showing the relationship between the power consumption for the rod mill used for mixing and the temperature of the mix at various times in the process.

VI. Following a communication of the board accompanying the summons to oral proceedings, both parties informed the board that they would not attend the scheduled oral proceedings. The respondent further withdrew its request for oral proceedings.

VII. Oral proceedings took place on 21 October 2005 in the absence of the parties.

VIII. The appellant principally argued as follows in writing:

The only essential difference between the subject-matter of the patent and the closest prior art D1 was the use of moisture and burnt lime instead of hydrated lime together with the molasses binder component of D1. D2 and D10 showed that the technical fields of mineral wool manufacture and fuel briquettes manufacturing were interrelated and that the skilled person in the art of mineral wool manufacture would certainly take into account teachings from the field of fuel briquettes and thus the teaching of D8. In D8, burnt lime was stated as being most preferred and D8 aimed at providing strong non-friable briquettes. Furthermore D9 showed that it was common general knowledge that burnt lime

reacts with water/ moisture to form hydrated lime while emitting heat. The interchangeability of burnt and hydrated lime for the purposes of the patent was supported by the fact that the hardened binder in the finished briquette would be the same material irrespective whether it was made from burnt lime or hydrated lime, and would thus have a similar stability in the cupola furnace. Thus there was no surprising or non-obvious effect in the claimed feature relating to the provision of a self-supporting column comprising the briquettes made according to the patent, as compared to using briquettes bonded with hydrated lime and molasses, as in D1, for example. The interchangeability of burnt lime with hydrated lime for the purpose of binding was also apparent from the patent itself because according to the latter and especially the examples, apparently equivalent and acceptable results were obtained with both types of lime, and thus there was no critical selection in selecting burnt lime over hydrated lime for the stated purpose. Any difference between the claimed subject-matter and the prior art comprised nothing more than self-evident optimisation of parameters well known in the art of briquette manufacture.

IX. The respondent put forward *inter alia* the following arguments in connection with inventive step:

The fact that burnt lime undergoes an exotherm with moisture so as to raise the temperature of the mix more rapidly than would otherwise occur contributed to the speed of the process. As a result of the raised temperature, the reaction between the overall charge and the molasses, (including the reaction between the

lime and the molasses) proceeded faster. This further contributed to the simplicity of the process and the strength of the required briquettes. As a result of letting the exotherm run and the mixture stiffen before transferring the product to the moulds, strong briquettes were formed rapidly during the moulding (without any post-cure) and little or no exotherm occurred in the moulds. Accordingly, the moulding produced briquettes which had high green strength faster, and cracking of the briquettes (that would occur if there was significant exotherm after moulding) was avoided since most or all of the exotherm occurred before moulding. The teaching the skilled person took from D8 was that best results were achieved using a combination of molasses and a hydraulic binder and that the process required a setting period (which was not surprising in view of the hydraulic binder) and that the process was best conducted using a dehumidifier or with gentle heating. Accordingly, the process of D8 was necessarily slow and required apparatus for post-heating or post-drying. The skilled person starting from Dl, and aware of the widespread use of hydraulic binders, would attach more interest to the disclosure of Portland cement binder than to the brief mention of molasses for making briquettes which are liable to crack. Anyone concerned with providing briquettes of good integrity would be worried about the warning of cracking at column 6, line 12 of D1 and so would be deterred from thinking further about that process, despite the vague assertion that "best results" were obtained in the process (D1, column 5, line 57).

X. The appellant requested in writing that the decision under appeal be set aside and that the patent be revoked.

The respondent requested in writing that the appeal be dismissed or in the alternative that the patent be maintained on the basis of the first or second auxiliary request, both submitted with letter of 19 December 2003.

Reasons for the Decision

1. The Board is satisfied with the findings of the Opposition Division that the amendments made to the claims during the opposition proceedings comply with the requirements of Articles 123(2) and (3) EPC, and that the subject-matter of these claims is novel over the cited prior art (Article 54 EPC). This not having been contested by any party during the appeal proceedings, no further comment on this matter is necessary.

2. It remains therefore to be decided whether the claimed subject-matter involves an inventive step or not.

2.1 As acknowledged by the parties, the closest prior art is represented by D1, which discloses (e.g. in claim 1) a process for producing light-coloured mineral wool comprising forming briquettes with a physically homogenized mixture of particulate inorganic material (including mineral wool production waste, cement kiln dust, clay, blast furnace slag, dolomite, Portland cement and a ground portion of wool production waste),

melting said briquettes in a cupola furnace, discharging the melt into a receiver, passing hot combustion gases into said melt to chemically homogenize and heat the melt to a predetermined temperature, and converting said melt into fibres. The briquettes are made by mixing the above particulate inorganic material including the binder in the presence of moisture, then transferring the stiff mix to a compaction moulding apparatus, e.g. a briquetting equipment (column 4, lines 48-63; column 5, lines 28-38; column 8, lines 33-39). As regards the binder, D1 prescribes the use of cement both in the claims as well as in the Examples VI through XI, these Examples being specific of the briquetting embodiment. D1 further discloses (column 5, lines 56-58) that for compaction by briquetting equipment, best results are obtained using a binder comprising 3% hydrated lime and 5-6% molasses or black liquor. The agglomerates manufactured in D1, in particular the briquettes, are described as having sufficient green strength so that they can be stockpiled immediately after moulding (column 5, lines 35-38; column 6, lines 1-3). Briquettes stored for three days at ambient temperature and at relative humidity of 85% are said to show satisfactory results when introduced into a cupola (column 6, lines 4-6).

Although not specifically described with respect to the briquettes embodiment, D1 (column 3, lines 23-27) also contemplates using fibres which emanate from cutting scrap created during the sawing of bats and boards prepared by treating mineral wool fibres with a binder such as a phenolic resin as a further source of waste for the agglomerates.

D1 does however not disclose nor suggest the use of burnt lime as a binder, neither alone nor in combination with molasses.

2.2 Starting from this prior art, the problem to be solved by the subject-matter claimed may be seen in the provision of a process for producing man made vitreous fibres using briquettes of inorganic material with high green strength which can be handled and used very soon after their manufacture, i.e. without prolonged curing or storage time (see paragraphs [0006] and [0039] of the patent in suit).

It is proposed to solve this problem by the process as defined in claim 1, which differs from the alternative of D1 including molasses and hydrated lime at least in that the briquettes are made by using burnt lime instead of hydrated lime as a component of the binder system. The fact that the briquettes obtained by a process according to the subject-matter claimed have a green strength such that they substantially all withstand a 2 meter drop test immediately after discharge from the moulds and that immediately after a standing time of half an hour the briquettes can be charged and used in a cupola furnace (column 10, lines 39-57 of the patent in suit) confirm that the above problem has actually been solved.

2.3 The appellant argued that the use of burnt lime instead of hydrated lime in combination with molasses was obvious to the skilled person in the light of the content of D1 taken in combination with the teaching of D8 and/or common general knowledge (as illustrated by D9).

2.4 Concerning D1, it is observed on the one hand that all the examples and the claims contain Portland cement as a component of the binder. On the other hand, nowhere in D1 is it disclosed that the agglomerates or briquettes can be used for the manufacture of mineral wool after a very short storage time of, for example, ½ hour. With respect to the embodiment wherein the binder comprises hydrated lime and molasses or black liquor, although this specific binder combination is disclosed at column 5, lines 56-59 as providing "best results" for compaction by briquetting equipment, attention is drawn to the fact that with this specific binder an exothermic effect is created during compaction, and therefore the green briquettes should be conveyed in a single layer to prevent cracking (column 6, lines 9-13). It is also noted that the preferred binder with respect to this embodiment is in fact described as containing 3% hydrated lime, 5-6% black liquor and 5% ground shot, i.e. no molasses (column 5, lines 60-67). This preferred three component binder is then described as providing sufficient green strength to the manufactured briquettes so that they can be stockpiled immediately after molding. Despite their sufficient green strength (for stockpiling), these briquettes do not appear to have the required properties for being used in a cupola furnace, since they show satisfactory results when introduced into a cupola after three days storage at ambient temperature at relative humidity no less than 85% (column 6, lines 1-9). In conclusion, in view of these teachings it is questionable whether the skilled person would consider the alternative comprising molasses and hydrated lime as a binder

representing a promising way of solving the problem stated above and would regard it as worthwhile to do further investigations therewith.

2.5 Before considering the prior art D8, the question arises whether a skilled person faced with problems specific to inorganic briquettes suitable for the manufacture of vitreous fibers would look for a potential solution in the field of fuel briquettes. In this respect, the appellant cited D10, a document which discloses coke briquettes, containing preferably up 75% of coke and/or coal, useful as an additional combustible in shaft furnaces for melting minerals in mineral wool manufacture and having sufficient strength for simultaneously withstanding the high furnace temperatures and the pressure of a stone column existing above the briquettes (D10, page 2, lines 1-16 and 24-32; claims 1 and 2). This prior art makes it evident that the two technical fields are interrelated, so that the skilled person faced with the problem of manufacturing inorganic briquettes intended for use in mineral fibers production would contemplate also looking in the field of fuel briquettes.

2.6 Under these circumstances, the skilled person would thus not be deterred from taking into consideration the teaching of D8, a document which addresses the problems associated with the use of molasses as an organic binder in fuel briquettes, namely its water solubility, its low weathering resistance and its prolonged hardening time (page 1, lines 13-15). D8 proposes to overcome these problems with a binder comprising molasses in an amount of at least 2% based on the weight of the briquette and a minor amount of a basic

oxide or hydroxide of an alkali metal or alkaline earth metal (page 1, lines 26-29; claim 1). Calcium oxide and calcium hydroxide are preferred, calcium oxide (i.e. burnt lime) being particularly preferred because it may be used in smaller amounts than calcium hydroxide while providing the same effect (page 1, lines 42-44). The basic oxide or hydroxide is described as reacting exothermically with the molasses to cause curing (setting) thereof, which can result in very hard briquettes with low friability (page 1, lines 38-39). Preferably, the fuel briquettes of D8 are described as further containing up to 10% of cement to enhance their water resistance (page 1, lines 45-48); in the sole example of D8 and in the preferred disclosure at column 1, lines 52-56, cement (preferably about 3%) is present in the briquettes composition. In said example, a small quantity of methylated spirit is further added, and as explained at page 1, lines 57-59, the alcohol is used to catalyse the reaction between the molasses and the basic hydroxide or oxide. The manufacturing process includes a forming step before allowing the briquettes to dry and harden (claim 8; page 2, lines 3-5), and a subsequent drying operation in a dehumidifier cabinet and/or by means of gentle heating is also envisaged (page 2, lines 5-7). In the example, after a pressing operation for forming the individual briquettes, the latter are left to dry and set in a dehumidifier cabinet. The briquettes thus obtained are described as being substantially non-friable and resistant to water absorption (page 2, lines 18-20).

2.7 The appellant argued that D8 taught the interchangeability of burnt and hydrated lime, burnt lime being preferred, and that it was common general knowledge that burnt lime reacts exothermically with water to form hydrated lime while emitting heat (D9). He thus concluded that it was obvious to replace hydrated lime by burnt lime in the process for making briquettes of D1, taking into account that D8 aimed at providing strong non-friable briquettes.

2.8 The board is not convinced by these arguments for the following reasons. Substantially non-friable briquettes were indeed obtained in the sole example of D8; this result was nevertheless achieved in the presence of 3% cement in the binder and with addition of an alcohol catalyzing the reaction between molasses and burnt lime; furthermore the briquettes were allowed to dry and set in a dehumidifier cabinet after their formation. D8 finally does not contain any information suggesting that similar results, i.e. substantially non-friable briquettes, might be obtained with materials different from carbonaceous fuel particles, e.g. with inorganic particles. It cannot be inferred from the results obtained with such a mixture - containing 77% anthracite coal dust as the main component and 3% cement in the binder - that briquettes with a high green strength would also be achieved in the case of a very different composition of the kind disclosed in D1 which contains essentially inorganic starting materials, and this without prolonged curing or storage after compaction of the briquettes. In this context, the appellant pointed out in his letter dated 28.10.2002 that D1 also contemplates the possibility of incorporating fuel particles (coke) into the

agglomerate with the mineral raw materials (D1, column 6, line 21). In this connection, the board observes however that according to column 6, lines 24-25 of D1, the amount of coke in the agglomerate cannot be higher than 10-15% by weight, which amount is relatively small in comparison with the amount of e.g. 77% anthracite coal in the example of D8. Furthermore, none of the examples of D1 contain coke in addition to the mineral raw materials, let alone in the alternative including molasses and hydrated lime as the binder.

Moreover, as already pointed out in item 3.4 *supra*, D1 teaches the risk of cracking due to the exothermic effect during compaction of the briquettes. As it is well-known that the reaction of burnt lime with water liberates heat, the skilled person is aware of the fact that replacing hydrated lime by burnt lime in the binder of D1 comprising molasses would produce additional heat and the question would thus obviously arise whether this would not further increase the risk of cracking. The board is of the opinion that in view of the above common general knowledge and of the warning about the risk of cracking already with hydrated lime, the skilled person would not be encouraged to replace hydrated lime by burnt lime in the binder of D1 since he would not expect such a replacement to solve the above problem but rather to increase the cracking risk and thus decrease the green strength of the briquettes. For the preceding reasons and taking further into account that in D8 a drying step and a setting step are performed after compaction of the mixture into briquettes, the board is not convinced that the skilled person faced with the problem stated above would contemplate trying burnt

lime in the briquettes composition of D1 with the expectation of solving this problem. It appears therefore that the appellant's conclusions as regards the lack of inventive step in view of a combination of D1 and D8 and of the common general knowledge (D9) is based on ex post facto analysis.

2.9 The remaining documents cited during the opposition proceedings were not relied upon by the appellant at the appeal stage. In the board's judgment neither D2 nor these documents contain further information which would point towards the claimed solution of the problem stated above.

2.10 In view of the arguments developed in items 2.1 to 2.9 *supra*, the board considers that the subject-matter of claim 1 (and of dependent claims 2-16) is not obvious to a person skilled in the art and therefore its subject-matter involves an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar: The Chairman:

A. Wallrodt M. Eberhard