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D E C I S I O N
of 2 February 2000

Case Number: T 0159/96 - 3.3.5

Application Number: 89303202.9

Publication Number: 0335735

IPC: C04B 33/32

Language of the proceedings: EN

Title of invention:
A process for firing ceramic shaped bodies and a tunnel kiln used therefor

Patentee:
NGK INSULATORS, LTD.

Opponent:
Riedhammer GmbH & Co.KG
Hans Lingl Anlagenbau und Verfahrenstechnik GmbH & Co. KG

Headword:
-

Relevant legal provisions:
EPC Art. 100(c), 123(2), 54, 56

Keyword:
"Amendments allowable"
"Novelty: yes"
"Inventive step: yes - unallowable ex post facto analysis"

Decisions cited:
-

Catchword:
-

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Case Number: T 0159/96 - 3.3.5

D E C I S I O N
of the Technical Board of Appeal 3.3.5
of 2 February 2000

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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 31 January 1996 concerning maintenance of the European patent No. 0 335 735 in amended form.**

Composition of the Board:

Chairman: R. K. Spangenberg

Members: A.-T. Liu
A. C. G. Lindqvist

Summary of Facts and Submissions

I. The appeal has been lodged by opponent Hans LINGL Anlagenbau und Verfahrenstechnik GmbH & Co. KG against the interlocutory decision of the opposition division maintaining European patent No. 0 335 735 in amended form.

II. The impugned decision was based on a set consisting of 3 claims submitted on 5 December 1994 as basis for the main request and an amended description as filed during the oral proceedings before the opposition division. Claims 1 and 2 were independent claims and claim 3 dependent upon claim 2. Claims 1 and 2 read as follows:

"1. A process for firing ceramic shaped bodies in the form of honeycomb structural bodies made by extrusion and containing shaping aid which is thermally decomposed at 150 to 300°C, which process comprises the step of making the temperature increase rate in a temperature range up to the decomposition temperature of the shaping aid smaller than that in a temperature range from the decomposition temperature of the shaping aid to a firing temperature, to prevent cracking due to temperature difference within the body caused by the thermal decomposition of the shaping aid.

2. A tunnel kiln comprising a preheating zone (1), a firing zone (2), a waste heat zone (3), combustion burners (6) provided at the firing zone, an exhaust means (4) provided at an inlet side of the preheating zone for evacuating combustion gases from the combustion burners from the kiln wherein in operation combustion gases from the combustion

burners at the firing zone pass along the whole length of the preheating zone (1) to the exhaust means (4) at the inlet side, the kiln further having another exhaust means (5) provided in a high temperature section of the preheating zone for evacuating combustion gases from the kiln, said other exhaust means (5) being connected to a portion of the preheating zone (1), upstream of said other exhaust means (5) with respect to the direction of movement of articles being fired in the kiln, for re-circulating at least part of the combustion gases evacuated through said other exhaust means."

III. The following document was considered by the opposition division to comprise the closest prior art teaching:

D1: Ziegelei-technisches Jahrbuch 1986, pages 117 to 144

IV. The opposition division held that the process of claim 1 was distinguished from the process according to D1 in that it concerned the firing of honeycomb bodies containing shaping aids and involved a different temperature schedule over the length of the kiln. Furthermore, these distinguishing features were found to be inventive since none of the cited prior art documents were directed to the manufacture of honeycomb shaped bodies.

Concerning claim 2, the opposition division considered that the amendments were not objectionable under Article 84 and 123(2) EPC. Furthermore, the apparatus according to claim 2 was held to differ from that of D1 in the functional feature of combustion gas flowing

along the preheating zone to the inlet side. An inventive step was accepted on the ground that the apparatus was specially designed for carrying out the process of claim 1.

V. In the statement of grounds of appeal, the appellant maintained the objection of lack of novelty and inventive step. At the same time, a new document was introduced into the proceedings:

D7: DE-C-3 517 866

VI. During oral proceedings held on 2 February 2000, the appellant contested the novelty of the subject-matter of claim 1 on the basis of D1 solely. Earlier submissions questioning the novelty of the claimed process with respect to further documents on file were expressly withdrawn.

The appellant argued that D1 concerned the same technical problem and proposed the same solution as stipulated in claim 1. It was therefore contended that the process according to claim 1 read on the process of D1 or at least lacked an inventive step with regard to D1.

The objection under Article 100(c) EPC was also elaborated upon during the oral proceedings. In this respect, the appellant submitted that the added feature in claim 2 "wherein in operation combustion gases from the combustion burners at the firing zone pass along the whole length of the preheating zone (1) to the exhaust means (4) at the inlet side" was not based on the application documents as originally filed.

Also in the oral proceedings, the appellant waived the objection that the tunnel kiln according to claim 2 lacked novelty. However, it was submitted that the kiln as claimed was obvious in view of Figure 8 of D1 in combination with the only Figure of D7.

VII. In reply to the grounds of appeal, the respondent contended that the process of claim 1 was new since the clay bricks of D1 were not honeycomb structures and the curve according to Figure 9 of D1 did not correspond to the wording of claim 1. Furthermore, the object to be achieved in D1 was to make the preheating curve as linear as possible. D1 therefore tended to lead away from the solution as proposed in claim 1.

The respondent submitted that the apparatus of claim 2 was inventive since the skilled person did not have any incentive to incorporate certain features of the kiln according to Figure 8 of D1 into the tunnel kiln according to the only Figure of D7.

VIII. During the oral proceedings before the Board of Appeal, the respondent filed a new set of amended claims to serve as basis for "Request IA". Two further sets of claims still on file were submitted as first and second auxiliary requests during the opposition proceedings on 11 December 1995.

IX. At the end of the oral proceedings, the parties' requests were as follows:

- The appellant (opponent) requested that the decision under appeal be set aside and the European patent No. 0 335 735 be revoked.

- The respondent (patentee) requested that the appeal be dismissed and the patent be maintained in the form of the main request which was the subject of the appealed decision or, auxiliarily, that the patent be maintained on the basis of the sets of claims filed on 11 December 1995 as first auxiliary request or on the basis of "Request IA" presented during the oral proceedings or on the basis of the set of claims filed as second auxiliary request on 11 December 1995.

Reasons for the Decision

Main request

1. *Claim 1*

1.1 Amendments

The Board is assured that the amendments to claim 1 meet the requirements of Article 123 EPC. No reasons need be given for this finding since the admissibility of these amendments has never been in dispute.

1.2 Novelty

The Board concurs with the appellant insofar as document D1 discloses a process for firing structured bodies containing a shaping aid which is thermally decomposed between 200 and 400°C (page 130, paragraph 2 and page 140, last paragraph). The Board also concedes that D1 mentions shaped bodies ("Hochlochziegel") which could be understood as having a honeycomb structure (page 130, line 6). However, it neither illustrates nor

describes in detail the firing process of these particular structures.

On the other hand, the temperature curve illustrated in Figure 9 of D1 is reported to be obtained with bricks made porous by the incorporation of polystyrene and sawdust (see last paragraph, page 140: "mit Polystyrol und Sägemehl porosierte Mauerziegel des Formates 12 DF"). The appellant has argued that these bricks always have a honeycomb structure. However, this has been contested by the respondent.

The Board remarks that the appellant, who has the onus of proof, has not provided any evidence in support of his assertion. Furthermore, he has not submitted, let alone proved, that the label "Format 12 DF" used for designating the bricks tested is known to relate to a particular structure. In the Board's view, the fact that (i) D1 expressly states how the bricks have been made porous and that (ii) they are designated as "Mauerziegel" and not "Hochlochziegel", as was earlier the case for bricks with honeycomb structure, would rather seem to indicate that these bricks have a different structure. The Board is therefore not convinced that the temperature curve represented in Figure 9 of D1 illustrates the firing process of a honeycomb structural body. Since claim 1 is specifically directed to the firing of "ceramic shaped bodies in the form of honeycomb structural bodies", the process as claimed is new with regard to D1. Concerning the other documents on file, the Board concurs with the uncontested findings in the decision under appeal.

1.3 Inventive step

The patent in suit concerns a process for firing honeycomb structural bodies containing shaping aid which is thermally decomposed at 150 to 300°C . It is stated that the through holes of these honeycomb structures are defined by thin partition walls. When these structures are fired under conventional conditions, cracks or deformation are likely to occur in some of the fired products (column 1, lines 17 to 27 and column 2, lines 38 to 40). Thus, the problem underlying the patent in suit can be seen in the provision of a firing process which produces fired honeycomb structures which have less defects (column 1, lines 29 to 31).

1.3.1 The patent in suit attributes the defects in the end products to the temperature difference between the inner and outer portion of the honeycomb which, in turn, is caused by the thermal decomposition of the shaping aid during the preheating phase (see column 2, lines 21 to 42). In order to avoid the formation of cracks, the patent in suit proposes subjecting the ceramic honeycomb structural body to a heating schedule with "the temperature increase rate in a temperature range up to the decomposition temperature of the shaping aid smaller than that in a temperature range from the decomposition temperature of the shaping aid to a firing temperature" (see claim 1).

1.3.2 The respondent has submitted that the firing process as claimed allows a gradual thermal decomposition of the shaping aid. This, in turn, smooths out the temperature difference between the inner and outer portion of the honeycomb. It is stated in the patent in suit that, as a result, cracks are prevented from occurring in the fired products (see column 4, lines 46 to 50). In view

of this effect which has not been queried by the appellant, the Board finds it credible that the problem as stated in point 1.3 is solved by the claimed process.

The only question that remains to be elucidated is therefore whether this problem has been solved in an obvious manner in view of the available prior art.

1.3.3 It is undisputed that D1 is also directed to a problem caused by thermal decomposition of organic materials occluded in shaped articles. As is explained in the introductory part of D1, one purpose for incorporating organic materials into the brick raw materials is to partly substitute the fuel later needed in firing these bricks. The burning out of these organic materials, however, gives rise to the emission of noxious gases which must be disposed of (see page 118, paragraphs 1 and 2; page 129, first full paragraph). Thus, the problem faced by D1 is the reduction of this gas emission.

The Board finds that the skilled person, in seeking to solve the present problem of preventing firing cracks, does not prima facie have an incentive to look into the teaching of D1 which addresses a different problem.

1.3.4 The Board does not ignore the fact that D1 also mentions that the heating schedule has an effect on the quality of the fired product (page 130, paragraph 3). The appellant contends that one of the desired qualities for fired bricks must be that they are free from cracks. Since this has not been contested by the respondent, the Board accepts in the appellant's favour that D1 may indirectly also address the problem of

preventing cracks in the process of firing shaped bodies.

In D1, it is stated that the presence of combustible materials in the brick raw materials has the effect of bending the preheating curve (page 119, end of third paragraph and page 123, last line to page 124, line 2). In order to counter this undesirable occurrence, the teaching of D1 aims at keeping the heating curve linear, i.e. avoiding the disturbance of uniform heating with respect to time. It is even specifically pointed out that the tests carried out have achieved the goal of making the temperature increase in the preheating zone comparatively linear (see page 130, paragraph 3; page 141, lines 5 to 6; page 142, paragraph 3 and Figure 9).

The process according to claim 1, in contrast, stipulates subjecting the shaped bodies to a temperature schedule wherein the heating rate up to the decomposition temperature of the organic materials is slower than that after said decomposition temperature. In other words, the present solution is that, instead of striving for a uniform heating rate as in D1, it is characterised by a heating programme with differing heating rates.

Thus, even if the skilled person had consulted D1, he would not have found therein any pointer to the solution as proposed in claim 1. The appellant's argument, according to which the skilled person would apply the temperature curve according to Figure 9 to solve the present problem, is therefore based on hindsight.

1.3.5 The Board also notes that the parties have contradicting views as to the interpretation of Figure 9 of D1. However, the correct interpretation of this temperature curve is irrelevant. In the Board's view, any resemblance between the heating curve illustrated in the prior art and the heating gradients as stipulated in claim 1 would be merely accidental for the reasons as elaborated under points 1.3.3 and 1.3.4.

1.3.6 During the oral proceedings, the appellant submitted that Figure 6 of the patent in suit corresponds to the description at page 130, last full paragraph of D1. From this observation, he went on to infer that the solution proposed by the patent in suit is the same as that of D1 .

As is discussed under point 1.3.4, the cited passage is about the linear heating programme which is found to be advantageous for the process of D1. The appellant's submission, insofar as the prior art teaching is concerned, is thus absolutely in line with the Board's findings. However, the Board cannot concur with the appellant in that Figure 6 is to represent the solution proposed by the patent in suit. As is explained in the description, this drawing illustrates the temperature difference which exists between the outer surface and the inside of a shaped body subjected to a conventional firing process (column 2, lines 21 to 34). As is clearly indicated in the drawing, the broken line and the solid line represent the temperatures of the inner and outer portion of the shaped body, respectively. Thus, the solid line referred to by the appellant cannot be construed as to foreshadow, much less to represent the heating scheme as stipulated in claim 1.

1.4 The appellant has not relied on any other prior art teaching which is susceptible of leading the skilled person to the solution as stipulated in claim 1 (see point VI). The findings in the decision under appeal concerning the other documents cited by the opponents thus remain uncontested. The Board therefore concludes that the process of claim 1 involves an inventive step.

2. *Claim 2*

2.1 Amendments

The present claim 2 differs from claim 2 as originally filed in that it includes the following features:

(i) "wherein in operation combustion gases from the combustion burners at the firing zone pass along the whole length of the preheating zone (1) to the exhaust means (4) at the inlet side"

and

(ii) "said other exhaust means (5) being connected to a portion of the preheating zone (1), upstream of said other exhaust means (5) with respect to the direction of movement of articles being fired in the kiln, for re-circulating at least part of the combustion gases evacuated through said other exhaust means".

It is no longer in dispute that feature (ii) is fairly based on claim 3 as originally filed.

2.1.2 The respondent confirmed during the oral proceedings that feature (i) is not disclosed expressis verbis in

the description but derived from the drawings, Figs. 2 and 3 as originally filed.

2.1.3 The appellant has objected to the term "whole length" as not being originally disclosed in these drawings with the following arguments.

The kiln as claimed is equipped with two exhaust means (4) and (5) (claim 2: "A tunnel kiln comprising ... an exhaust means (4) ... further having another exhaust means (5) ... connected to a portion of the preheating zone (1), upstream of said other exhaust means (5)"). The wording of claim 2 does not exclude the configuration of the second exhaust means (5) being connected to a portion of the preheating zone also upstream of the first exhaust means (4). In this case, the part of the kiln upstream of the first exhaust means (4) is also part of the preheating zone.

Based on the above interpretation, the stipulation that combustion gases "pass along the whole length of the preheating zone" implies that the gases are required to pass beyond the exhaust means (4) up to the inlet. This feature, however, is not in conformity with Figs. 2 and 3 which show that the gases are evacuated at the exhaust means (4) before reaching the inlet.

2.1.4 The Board concurs with the appellant in that claim 2 encompasses the configuration of the second exhaust means (5) being connected to a portion of the preheating zone also upstream of the first exhaust means (4). However, the question as to whether or not the portion of the kiln upstream of the first exhaust means (4) should be regarded as part of the preheating zone is not relevant in respect of the admissibility of

the amendment (i) under discussion.

The Board finds that claim 1 defines the path of the combustion gases with a precise starting and end point, namely at the location of the combustion burners and at the exhaust means (4) respectively (claim 2: "from the combustion burners ... to the exhaust means (4)"). In the Board's view, the expression "whole length of the preheating zone" in the present phrasing therefore clearly refers to the portion of the kiln between these two points of the preheating zone. The appellant has not contested that the feature of the kiln being constructed such to allow combustion gases to pass along the preheating zone between these two points is clearly and unambiguously derivable from the drawings. The Board therefore concludes that claim 2 satisfies the requirements of Article 100(c) EPC.

2.2 Novelty

The objection of lack of novelty was waived in the oral proceedings. Indeed, none of the available prior art documents discloses a tunnel kiln:

(i) having an exhaust means in a high temperature section of the preheating zone connected to an upstream portion of the preheating zone and

(ii) further constructed such that, in operation, combustion gases are allowed to pass along the whole length of the preheating zone to the exhaust means at the inlet side.

2.3 Inventive step

2.3.1 Claim 2 relates to a tunnel kiln effective for firing shaped bodies containing shaping aid.

2.3.2 The Board accepts the appellant's argument that D1, directed to the same technical field, should be considered to comprise the closest prior art teaching for the present invention.

The tunnel kiln according to Figure 8 of D1 is characterised by the provision of a closed carbonisation chamber ("Schwelkammer") within the preheating zone and a gas bypass for recirculating combustion gases from the firing zone back to the preheating zone without passing through the carbonisation chamber (Figure 8; page 137, last two paragraphs and page 139, last paragraph).

2.3.3 According to the patent in suit, the technical problem underlying the invention is the provision of a tunnel kiln specifically adapted to conduct the firing process according to claim 1, which produces fired shaped bodies free from defects (column 1, lines 28 to 32).

As is discussed earlier, the tunnel kiln according to D1 is also effective for producing shaped bodies free of firing cracks (see point 1.3.4). Thus, the Board holds that the problem to be solved by the invention with respect to D1 is the provision of a further tunnel kiln with the same effect.

2.3.4 The tunnel kiln according to claim 2 is distinguished from the closest prior art in that it does not incorporate a closed carbonisation chamber so that, in operation, combustion gases to be recirculated pass along the whole length of the preheating zone and not

via a bypass as in D1.

2.3.5 The construction of the tunnel is described as being effective for conducting the present firing process (column 3, line 23 to column 4, line 28). In the Board's judgment, it is immediately apparent that the problem as stated in point 2.3.3 is solved by the tunnel kiln modified as stipulated in claim 2. This has not been challenged by the appellant.

The remaining question is therefore whether the proposed modification is obvious in view of the available prior art.

2.3.6 The appellant has advanced the argument that D1 already suggests providing a kiln with a through flow of gases. A similar tunnel kiln constructed such as to allow a through flow of gases is shown in D7 (see the only Figure). The appellant has alleged that it was therefore obvious for the skilled person to effect the suggested modification and thereby arrive at the subject-matter of claim 2 (see letter dated 29 May 1996, page 5, point c).

The Board cannot share the appellant's view that D1 suggests providing a kiln with a through-flow of gases. As is indicated in point 1.3.3, the problem to be solved in D1 is the reduction of noxious gases emitted in the process of firing bricks. It is also undisputed that this problem is solved in D1 by the provision of a closed carbonisation chamber ("Schwelkammer"). The extraction and re-injection of gases via a bypass as illustrated in Figure 8 of D1 is due to the presence of this closed chamber.

It is true that, according to D1, it was initially envisaged leaving the downstream door of the chamber open, with the aim to let in a certain amount of gas (page 141, last 3 lines). However, this embodiment was found to be unacceptable. For this reason, it was eventually recommended in D1 that the same door be kept closely shut so that the chamber is separated from the succeeding firing zone as effectively as possible (page 142, lines 1 to 3). The appellant has not submitted any plausible reason why the skilled person would deviate from this salient feature of the prior art teaching. The Board therefore holds that the appellant's random combination of features from D1 with a particular feature of D7 is the result of an inadmissible ex-post facto analysis.

Since the subject-matter of claim 2 cannot be derived from the cited prior art documents in an obvious way, the kiln as claimed involves an inventive step.

3. The patentability of claim 3 is supported by that of claim 2 on which it depends.

The appellant has not raised any objection against the description (including the drawings) which has been adapted to the amended claims.

The main request is therefore allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Hue R.Spangenberg