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**Datasheet for the decision
of 6 November 2006**

Case Number: T 0503/04 - 3.3.05

Application Number: 99934229.8

Publication Number: 1060146

IPC: C04B 7/00

Language of the proceedings: EN

Title of invention:

Kiln plant and method for manufacturing cement

Patentee:

F.L. Smidth & Co. A/S

Opponent:

KHD Humboldt Wedag GmbH

Headword:

Cement kiln plant/SMIDTH

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes) "

Decisions cited:

-

Catchword:

-



Case Number: T 0503/04 - 3.3.05

DECISION
of the Technical Board of Appeal 3.3.05
of 6 November 2006

Appellant: KHD Humboldt Wedag GmbH
(Opponent) Dillenburger Strasse 69
D-51170 Köln (DE)

Representative: Christl, Hermann
Deutz AG
Patente und Marken
Abt. KR-P
D-51057 Köln (DE)

Respondent: F.L. Smidth & Co. A/S
(Patent Proprietor) 77 Vigerslev Allé
DK-2500 Valby
Copenhagen (DK)

Representative: Brunner, Michael John
Gill Jennings & Every LLP
Broadgate House
7 Eldon Street
London EC2M 7LH (GB)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 16 February 2004
rejecting the opposition filed against European
patent No. 1060146 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: M. Eberhard
Members: J.-M. Schwaller
H. Preglau

Summary of Facts and Submissions

I. The appeal was lodged by the opponent against the decision of the opposition division to reject the opposition against the European patent EP-B-1 060 146.

Independent claims 1 and 5 of the patent read as follows:

"1. A kiln plant for manufacturing cement, said plant comprising a kiln (1), a cooler (4), a calciner (2) with subsequent separation cyclone (9), a burning compartment (3) provided at its upper part with a central burner (16), and featuring below the burner a tangential inlet through which hot gas is fed, via a duct (5), from the cooler (4) to the burning compartment (3), said duct (5) being provided with an inlet (14A) for raw meal, the lower part of the burning compartment (3) being provided with a connection (7) to the calciner (2), and a second connection (6) directing the exhaust gases from the kiln (1) to the calciner (2), characterised in that the height, h_1-h_2 , of the upper part of the inner volume of the burning compartment (3), between the tip of the burner and the upper edge of the tangential inlet, being the uppermost point of entry of hot gas from the cooler is at least $1/3 D$, where D represents the diameter of a cylinder having the height h_1-h_2 and the same volume as the upper part of the inner volume of the burning compartment; and in that the height of the lower part of the inner volume of the burning compartment, h_3-h_4 , being situated between the lower edge of the tangential inlet, being the lowermost point of entry of hot gas from the

cooler, and the outlet from the burning compartment (3), is at least D .

5. A method for manufacturing cement in a plant according to claim 1, wherein the raw materials are preheated and then subjected to at least partial calcination in a burning compartment (3) which at its upper part is provided with a central burner (16); where raw materials are fed to the burning compartment (3) via a tangential inlet suspended in hot gas from a cooler (4); the partially calcined material is passed from the lower part of the burning compartment via a connection (7) to a calciner (2), the gas/material suspension is passed from the calciner (2) to a separation cyclone (9), in which a separation of gas and material is effected, and where exhaust gases from the kiln (1) is directed to the calciner (2) via a second duct (6), characterized in that the height h_1-h_2 of the upper part of the inner volume of the burning compartment, between the tip of the burner and the upper edge of the tangential inlet, being the uppermost point of entry of hot gas from the cooler is at least $1/3D$, where D is the diameter of a cylinder with the height h_1-h_2 and the same volume as the upper part of the inner volume of the burning compartment; and in that the height of the lower part of the inner volume of the burning compartment, h_3-h_4 , being situated between the lower edge of the tangential inlet, being the lowermost point of entry of hot gas from the cooler, and the outlet from the burning compartment (3), is at least D ."

II. The decision, which relied on D1: ZEMENT-KALK-GIPS, Nr. 12/78, p. 595-601, can be summarised as follows:

Both independent claims 1 and 5 recite the following feature "*the height, h_1-h_2 , of the upper part of the inner volume of the burning compartment (3), between the tip of the burner and the upper edge of the tangential inlet, being the uppermost point of entry of hot gas from the cooler is at least $1/3 D$, where D represents the diameter of a cylinder having the height h_1-h_2 and the same volume as the upper part of the inner volume of the burning compartment*" (hereinafter feature i)). This feature implies that the diameter D is constant within the part of the burning compartment where the height is h_1-h_2 . In D1, the burning chamber has two different diameters in the range wherein the height is h_1-h_2 and the diameter of the burning chamber is thus not constant. The subject-matter of claims 1 and 5 of the patent in suit is therefore novel over D1.

The above claims also meet the requirements of Article 56 EPC for the following reasons. The object of the invention is to provide a kiln plant and a method for manufacturing cement, which kiln plant is of a relatively simplified construction. This problem is solved by the subject-matter of claims 1 and 5, which is distinguished from D1 by feature i). This feature results in a simplified construction because the diameter D is constant within the part of the burning compartment where the height is h_1-h_2 and a chamber of only one diameter is needed.

In D1, the construction requires in contrast an extra chamber of reduced diameter on the top of the "swirl calciner" having a larger diameter. D1 does not lead the skilled person to simplify the construction of a

kiln in the way indicated in the contested patent because it does not contain any hint towards dimensions or construction other than those disclosed in the particular embodiments.

- III. With the grounds of appeal, the appellant (opponent) filed the new document D2 = DE-C-2248030 and argued that the subject-matter of claims 1 and 5 lacked an inventive step over D1 in combination with D2.
- IV. In a communication, the board noted *inter alia* that the measurement of the distance h_1-h_2 on Figures 5 and 6 of D1 would not seem to be in agreement with the Case Law of the Boards of Appeal of the EPO, 4th edition 2001, according to which dimensions obtained merely by measuring a diagrammatic representation in a document do not form part of the disclosure.

The board further submitted that the mixing chamber disclosed in D1 could be assimilated to a calciner in the sense of independent claims 1 and 5, because as shown in Figures 5 and 7 of D1, a degree of decarbonation of 40 % was achieved in the swirl calciner whereas a decarbonation of at least 85 % was reached in the mixing chamber; which would mean that a calcination was actually operated therein.

- V. During the oral proceedings, which took place on 6 November 2006, the respondent (patentee) confirmed that claim 1 did not require that the diameter D be constant within the part of the burning compartment where the height is h_1-h_2 . He also no longer contested that the mixing chamber of D1 would correspond to a calciner in the sense of the patent in suit.

The appellant admitted that the subject-matter claimed was novel over D1. Regarding its objection of lack of inventive step, he no longer relied on a combination of D1 with D2, but on D1 alone, arguing that D2 was used only as a textbook.

VI. The appellant essentially submitted the following arguments:

As seen from Figures 1 and 12 of D1, the control damper on the duct conveying air from the cooler to the swirl burner could be closed. As a consequence of this closure, the upper part of the swirl calciner illustrated in Figure 7 of D1 would be provided with a raw meal-free space, in which the centrally located burner would generate a jet stream in the same way as in the mixing chamber 92 in Figure 7 of D2.

In the case of oil or gas firing, the apparatus defined in claims 1 and 5 of the patent in suit would allow the generation of a jet stream having the flow pattern shown in Figure 2 of the patent in suit. In the case of coal firing, a gaseous medium would be needed for conveying the solid fuel and since in the patent claims the necessary gaseous conveying medium is only contemplated in dependent claims 4 or 8, which define the feed of primary air through the burner, it is clear for the skilled person that a jet stream having the defined flow pattern would not be obtained in the absence of said primary air.

The apparatus as claimed could not be considered as simplified over the one disclosed in D1. In fact D1

proposes a simpler apparatus since the diameter is only as large as necessary. Furthermore, owing to the smaller diameter of the swirl burner in D1, less material would be needed for its construction and thus the apparatus of D1 would obviously be more economic than the one claimed.

The presence of a stabilizing burner - like the one illustrated in Figure 7 of D1 - is not excluded from the subject-matter of independent claims 1 and 5.

In view of the teaching of D1, the skilled person would arrive in an obvious manner at the dimensions defined in the characterizing part of claims 1 and 5 because, on the one hand, he knows that a raw-meal free space is needed in the upper part of the swirl calciner for good ignition of the fuel, and, on the other hand, raw meal suspended in the tertiary air would have to be injected in the upper third of the swirl calciner to reach the 40% decarbonation rate disclosed in D1.

VII. The respondent (patentee) principally argued as follows:

The problem to be solved in the patent in suit would be the provision of a simplified plant having the advantages of the prior art plants, i.e. a plant which would allow the firing of low reactivity fuels with high combustion efficiency, avoiding caking and which would have low NOx emissions.

The plant defined in independent claims 1 and 5 would not need a stabilizing burner as in D1, because by fulfilling the requirement $h_1 - h_2 \geq 1/3 D$, a stabilized

combustion would automatically be obtained in the raw meal-free upper part of the burning compartment.

D1 required that the flow of air from the cooler to the swirl burner be automatically maintained constant, which would mean that the control damper materialized e.g. in Figure 12 could not be closed. Accordingly, the real uppermost point of entry of hot gas (tertiary air) in D1 would be the duct close to the tip of the burner(s) as seen in Figures 6 and 7.

VIII. The appellant requested that the decision under appeal be set aside and that the patent be revoked.

The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The subject-matter of claims 1 and 5 is novel over the cited prior art. This was no longer disputed at the oral proceedings.
2. D1, which is considered to represent the closest prior art, discloses (see Figures 1 and 12) a plant for calcining cement raw materials using the RSP (reinforced suspension preheater) process with bypass. Said plant includes *inter alia* a rotary kiln, a grate cooler, a mixing chamber (corresponding to the calciner (2) in the patent in suit), several cyclones and a swirl calciner. The exhaust gases from the kiln are delivered to the lower part of the mixing chamber and the upper part of the mixing chamber is connected with stage 4 cyclone C4. The lower part of the swirl

calciner is connected via a duct to the mixing chamber. On top of the swirl calciner a swirl burner is located (Figure 6). The entity consisting of the swirl calciner and swirl burner is called a "swirl furnace" or "Wirbelkammer" in Figure 5 of D1 and corresponds to the burning compartment (3) in the patent in suit. The swirl burner has a smaller diameter than the swirl calciner and is provided with a central burner. When coal is fired, the central burner is supplemented with another burner, also called "stabilizing burner", or with several further burners depending on the size of the plant (D1, Figure 7; page 599, paragraph 6.2).

3. The hot air from the cooler is fed on the one hand to the swirl burner and on the other hand to the swirl calciner (Figure 6). The hot air duct from the cooler is split into three streams, two of them - corresponding to 90% of the flow of air from the cooler - are fed tangentially into the swirl calciner via ducts located at 180° from each other, each duct being provided with an inlet for raw material and entering the swirl calciner close to and below the junction with the swirl burner. The third stream, which corresponds to the remaining 10% of hot air from the cooler, is fed radially via an annular duct into the upper part of the swirl burner and the hot air enters the swirl burner via tangential slits (paragraph bridging the left and right columns of page 598; Figure 5).

The appellant's argument that in D1 the control damper located in the duct conveying the third air stream can be closed does not convince the board, because the last two lines of the right column at page 600 of D1 unequivocally disclose that the air stream to the swirl

burner is automatically maintained constant, which means that the control damper would not be closed during operation.

Regarding the third stream of hot air from the cooler, it can be seen from Figure 5 of D1 (see also Figure 6) that it enters the swirl burner at a position relatively close to the tip of the burner. This means that the upper edge of the tangential inlet, being the uppermost point of entry of hot gas from the cooler, is in D1 relatively close to the tip of the burner. As a consequence, in D1 the height h_1-h_2 as defined in claims 1 and 5 of the patent in suit would in any case not meet the requirement $h_1-h_2 \geq 1/3 D$, even if measurement of dimensions on the schematic representation of Figure 6 were allowable. In the present case, it is clear that Figure 6 is a schematic representation, because at least the oil nozzles and the second duct providing raw meal and air from the cooler - clearly visible in Figure 5 - have not been reproduced in the swirl calciner represented at Figure 6. Furthermore, a scale which would allow an accurate measurement of dimensions in Figure 6 is also lacking therefrom. In consequence, any dimension which could be obtained from the diagrammatic representation of Figure 6 does not form part of the disclosure (see also the Case Law of the Boards of Appeal, 4th edition 2001, I.C.2.6).

4. The subject-matter of independent claims 1 and 5 thus is distinguished from the disclosure of D1 at least in that the height, h_1-h_2 , of the upper part of the inner volume of the burning compartment, between the tip of the burner and the upper edge of the tangential inlet, being the uppermost point of entry of hot gas from the

cooler, is at least $1/3 D$, where D represents the diameter of a cylinder having the height h_1-h_2 and the same volume as the upper part of the inner volume of the burning compartment (feature i)).

5. As regards the problem to be solved by the subject-matter of claims 1 and 5, it is noted that D1 discloses (see "Summary" on pages 595 and 596, in particular items 1., 2. and 7.) that the RSP system can offer many advantages over conventional systems. Besides the general advantages of lower initial equipment cost, reduced maintenance costs, process stability and low NO_x emissions, the RSP-system offers the following specific advantages. In particular, the swirl furnace burns all fuels completely within itself, handles high-sulphur coals with either low or high volatile content and ignition takes place in clean-burning atmosphere, before raw materials are introduced. Furthermore coatings do not occur in the swirl burner, swirl calciner, mixing chamber, rising duct or stage 4 cyclone. It thus appears that this prior art plant for calcining clinker raw materials already provides the advantages indicated in the patent in suit, namely providing a kiln with relatively simplified construction and which can burn fuel with low reactivity and at low NO_x emissions (see in particular paragraphs [0007] and [0021] of the patent in suit). In the absence of comparative tests with D1, an improvement in terms of ignition, combustion efficiency, NO_x reduction or reduction of the cakings, can thus not be acknowledged in the subject-matter claimed.

Regarding the respondent's argument that in comparison with the apparatus at Figure 7 of D1 - which requires a

stabilizing burner - the apparatus defined in claims 1 and 5 would be of a more simplified design due to the absence of such a burner, it is noted that neither the apparatus nor the process defined in claims 1 and 5 is restricted to the burning of coal. Accordingly, for assessing inventive step, not only the design of the apparatus of Figure 7 - directed to coal firing - but also that of Figure 6 - directed to oil firing - must be taken into account. It is noted that the swirl chamber illustrated in Figure 6 of D1 does not seem to require such a stabilizing burner, so that the advantage of a simplified design cannot be accepted, at least regarding the apparatus with oil firing.

6. Owing to the above considerations, starting from D1 as the closest prior art, the problem to be solved by the subject-matter claimed may then be seen in the provision of another kiln plant as well as another method for manufacturing cement having low NO_x emissions, low cakings, high combustion efficiency and allowing to burn fuel with a low reactivity.
7. In view of the information given in particular in paragraphs [0007], [0010], [0019], [0020] and [0021] of the patent in suit, it is credible that the above problem has been solved by the claimed kiln and process.
8. As indicated in item 4. *supra*, the claimed kiln plant and process differ from those of D1 at least as regards feature i).

The appellant argued that it was obvious to the skilled person faced with the problem indicated above to relocate the uppermost entry of hot gas from the cooler

so as to arrive at a height h_1-h_2 as defined in independent claims 1 and 5 of the patent in suit because, on the one hand, he knew that a raw-meal free space was needed in the upper part of the swirl calciner for good ignition of the fuel, and, on the other hand, raw meal suspended in the tertiary air would have to be injected in the upper third of the swirl calciner to reach the 40% decarbonation rate disclosed in D1. The board is not convinced by this argument for the following reasons.

D1 contains no information suggesting that by moving the uppermost point of entry of hot gas downwardly from the cooler (i.e. the point of entry of tertiary air) and thus shifting it away from the tip of the burner by a distance such that $h_1-h_2 \geq 1/3 D$, the problem stated above - i.e. obtaining low NO_x emissions, low cakings, high combustion efficiency and allowing the burning of low reactivity fuel - might be solved.

As pointed out by the respondent, because of the claimed low position of the tertiary air inlet, the jet stream through the burner generates the flow pattern illustrated in Figure 2 of the patent in suit (see also paragraph [0020] of the patent in suit). In contrast, in D1 the uppermost tertiary air inlet located close to the tip of the burner does not make it possible to establish such a flow pattern, and D1 does not suggest at all that such a flow pattern should be generated, let alone how it should be generated. Therefore, in the absence of any information concerning said specific flow pattern in D1, this document can also not give the skilled person an incentive to move the point of entry of the tertiary air downwardly by the distance

$h_1-h_2 \geq 1/3 D$ in order to solve the problem stated above.

The appellant argued at the oral proceedings that a flow pattern according to Figure 2 of the patent in suit would not be obtained in the alternative where coal was used as fuel, since feeding the primary air through the burner was only described in dependent claims 4 and 8. This argument is not convincing since claims 1 and 5 encompass several possible possibilities regarding the fuel to be used (i.e. solid fuel such a coal, but also liquid or gaseous fuels) and it is immediately apparent to the skilled person that in the alternative where the fuel would be coal, a carrier gas would be necessary for its introduction into the burning compartment.

Therefore the appellant's arguments appear to be based on an analysis of the case with hindsight.

9. D2 can also not suggest the solution to the problem indicated in item 6. *supra*, because in this document the uppermost entry of hot gas from the cooler is located at the same level as the burners (see Figures 7 and 8), which means that the height h_1-h_2 between the uppermost entry of hot gas from the cooler and the tip of the burner is zero. D2 furthermore does not disclose any central burner and the duct connected to the uppermost inlet for hot gas from the cooler is not provided with an inlet for raw meal.

10. Accordingly, for the reasons indicated above, the subject-matter of independent claims 1 and 5 cannot be considered as being obvious to a person skilled in the

art in view of the cited prior art. Claims 2-4 being dependent on claim 1 and claims 6-9 being dependent on independent claim 5 (which itself makes reference to the plant of claim 1), these claims therefore also meet the requirements of Article 56 EPC and the patent is thus upheld.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar:

The Chairman:

G. Rauh

M. Eberhard