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D E C I S I O N
of 6 November 1997

Case Number: T 0119/96 - 3.2.3

Application Number: 87305943.0

Publication Number: 0258977

IPC: F27B 7/20, F27D 13/00, C04B 7/44

Language of the proceedings: EN

Title of invention:
Apparatus for roasting fine grained material

Patentee:
FULLER COMPANY

Opponent:
Krupp Polysius AG

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Inventive step - after amendment (yes)"

Decisions cited:
G 0007/95

Catchword:
-



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Case Number: T 0119/96 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 6 November 1997

Appellant:
(Opponent)

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Respondent:
(Proprietor of the patent)

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Decision under appeal:

Interlocutory decision of the Opposition Division
of the European Patent Office posted 29 November
1995 concerning maintenance of European patent
No. 0 258 977 in amended form.

Composition of the Board:

Chairman: C. T. Wilson
Members: H. Andrae
L. C. Mancini

Summary of Facts and Submissions

- I. European patent No. 0 258 977 was granted on 17 March 1993 on the basis of European patent application No. 87 305 943.0.
- II. An opposition against the granted patent was filed by the Appellant (Opponent) who requested revocation of the patent in its entirety on the ground that its subject-matter lacked an inventive step with respect to the state of the art.

In the Statement of Opposition reference was made to the following documents:

- (D1) DE-A-2 329 159
- (D2) DE-Z "Zement-Kalk-Gips", Nr.5/1984, pages 219 to 225
- (D3) DE-B-2 343 339
- (D4) DE-A-3 023 541

- III. In its decision given at the oral proceedings on 27 June 1995 and issued in writing on 29 November 1995, the Opposition Division held that the patent was to be maintained in amended form on the basis of Claims 1 to 9 filed during the oral proceedings.

The Opposition Division was of the opinion that the subject-matter of the independent Claims 1 and 6 was novel and inventive over the cited prior art, in particular because the prior art did not disclose or hint at the combination of the third conduit for bypassing some material directly to the clinkering furnace around the first and second conduits with the separating means to solve the technical problem of clogging.

- IV. An appeal was filed against this decision by the Appellant on 25 January 1996 and the appeal fee paid on the same day. The Appellant requested that the decision under appeal be set aside and the patent be revoked.

In the Statement of Grounds of Appeal filed on 22 February 1996, the Appellant cited for the first time

(D5) DD-B-146 280.

He submitted that the subject-matter of Claim 1 lacked an inventive step with regard to (D5) and (D2) on the one hand and with regard to (D1) and (D3) or (D4) on the other hand. He further held that the subject-matter of Claim 6 was anticipated by (D1) (clearly "(D5)" was intended) and was not inventive with regard to the disclosure of (D1) and (D3) or (D4).

- V. In a communication dated 15 July 1997, the Board expressed the provisional opinion that (D1) disclosing the nearest prior art did not seem to describe means for by-passing material around the recirculating and the discharging means and means for separating coarse particles from the at least partially roasted fine grained material. The Board was also doubtful that (D2) could be considered to give a hint that the fluidized bed described should be used as a fluidizing gravity conveyor for the purpose of reducing the overall height of the calcinating apparatus. Further according to the communication, a combination of the disclosures of (D1), (D2) and (D3) or (D4) would also not give any hint of separating grained material in accordance with the particle size in order to avoid plugging of the recirculation system of the calcining apparatus.

The Board emphasized that (D5) had been filed late and did not appear to be of more relevance than the documents already on file. In accordance with the established jurisprudence of the Boards of Appeal, the Board intended not to admit this document into the proceedings (Article 114(2) EPC).

VI. Oral proceedings before the Board were held on 6 November 1997 during which the Respondent submitted new documents including independent Claims 1 and 6 which had been delimited vis-à-vis (D1).

The Respondent requested that the appeal be dismissed and that the patent be maintained on the basis of the amended description, amended Claims 1 to 9 and Figures 1 to 3 of the drawings, all submitted at the oral proceedings.

Claims 1 and 6, respectively, read as follows:

"1. Apparatus for producing cement clinker comprising a preheater (1); a calcining furnace means (2) having a material inlet (25) and a material outlet (22); a clinkering furnace (30) having a material inlet (31) and a material outlet (32) and a cooler (4) wherein fuel is supplied to and combustion takes place within both of said calcining furnace (20) and said clinkering furnace (30) and cement raw meal is preheated in said preheater by means of exhaust gases from at least one of said calcining furnace (20) and said clinkering furnace (30) and sequentially supplied from said preheater to said calcining furnace (20), clinkering furnace (30) and said cooler (4); whereby there is provided a riser duct (35) for supplying exhaust gas from the clinkering furnace (30) to the calcining furnace means (2); means defining a first conduit (70, 75, 78, 71) for supplying calcined material from the material outlet (13) of calcining furnace means (2) to

the material inlet of the clinkering furnace (30); means for recirculating at least a portion of the cement raw meal from the material outlet (13) of the calcining furnace means (2) through the calcining furnace means before it is supplied to the clinkering furnace (30) including means defining a second conduit (70, 75, 76) flow connecting the material outlet (13) of the calcining furnace means (2) with the riser duct (35), characterised by said second conduit being a fluidizing gravity conveyor; and means defining a third conduit (71) for by-passing some material directly to the clinkering furnace (30) around said first and second conduits, wherein means (72) are associated with said second conduit (70, 75, 76) for separating coarse particles from the calcined material and wherein said third conduit (71) supplies said coarse particles directly to the clinkering furnace (30)."

"6. Apparatus for roasting fine grained material such as cement raw meal, lime or dolomite comprising a furnace (2) having an inlet for gas for combustion, an inlet (25) for raw fine grained material to be roasted, an inlet for fuel for combustion in said furnace and an outlet (22) for spent combustion gas and at least partially roasted fine grained material; a gas-solids separator (10) having an inlet (11) for spent combustion gas and at least partially roasted fine grained material flow connected to the outlet of said furnace (2), a first outlet (13) for separated at least partially roasted fine grained material and a second outlet (12) for separated spent combustion gas; recirculating means (70, 75, 76) and discharging means (70, 75, 78, 71) for recirculating a portion of the at least partially roasted fine grained material from the first outlet (13) of said gas-solids separator (10) to said furnace (2) and for discharging the remainder of the at least partially roasted fine grained material, characterised in that there is provided means (71) for

by-passing material around said recirculating means (70, 75, 76) and discharging means (70, 75, 78, 71), and means (72) for separating coarse particles from the at least partially roasted fine grained material and for discharging large particles through said means for by-passing material (71) and for permitting the remaining at least partially roasted fine grained material to be supplied to said recirculating means (70, 75, 76) and discharging means (70, 75, 78, 71)."

VII. In support of his request for revocation of the patent the Appellant argued essentially as follows:

- It is admitted that (D1) as the nearest prior art does not disclose the features (i), (k), (l) and (m) of Claim 1 as classified in the Statement of Grounds of Appeal. The problem underlying the arrangement of a fluidizing gravity conveyor (feature (k)) is to reduce the overall height of the claimed apparatus.

Since with regard to this problem a conveyor chute cannot be used, a fluidizing gravity conveyor remains as the only choice, since other conveyor types such as a pneumatic conveyor or a scraper or worm conveyor are not acceptable due to problems in respect of the air mass flow requirements in the calcining furnace or in respect of the thermal stability of the conveyor elements.

Whenever it is found out that coarse particles of the calcined material lead to plugging of the recirculation duct, a simple solution for the skilled person would be to provide separating means at the material outlet of the calcining furnace. Following logically from this step in order to avoid permanent recirculation of fine particles through the recirculation means, a third

duct would have to be provided, arriving thereby at the combination of features of Claim 1. Since these steps are inevitable for the solution to the underlying problem, Claim 1 lacks an inventive step.

- As compared to Claim 1, Claim 6 does not contain the feature concerning a fluidizing gravity conveyor. Vis-à-vis (D1), the features relating to the separating means and to the third conduit are novel. The problem to be solved by Claim 6 has to be seen in avoiding plugging of the recirculation duct by coarse particles. Again, the skilled person is led unavoidably to the provision of separating means and a third conduit as explained above in connection with Claim 1. It follows that also Claim 6 is not inventive in the light of (D1).

VIII. The arguments of the Respondent can be summarised as follows:

- (D1) does not give any hint to provide a third duct besides the duct (22) (first conduit) and the duct (40) (second conduit) in order to by-pass the first and the second conduit and supply part of the material immediately to the rotary kiln (30). The outlet (21) of the first cyclone (7) is connected to the rotary kiln (1) by means of the duct (22) so that the skilled person would not consider a further duct to be required. (D1) also does not suggest to design the recirculation duct (40) as a fluidizing gravity conveyor. In (D2) there is no disclosure that the recirculation system according to (D1) could be improved by means of such a conveyor. Furthermore, (D1) does not hint at arranging means for separating coarse particles from the calcined material in a

recirculation system such that the coarse particles are supplied directly to the rotary kiln by means of a third conduit. Since in the apparatus described by (D1) the second conduit has not been designed as a fluidizing gravity conveyor, the skilled person would not provide means for separating the coarse particles from the calcined material. Although separating means as such are known from (D3) and (D4), it is not obvious for the skilled person to make use of such means in combination with a recirculation system consisting of three conduits. By combining the three conduits with the separating means and the fluidizing gravity conveyor, a recirculation system has been created which is of small overall height and is reliable as regards operation safety.

- Claim 6 is distinguished from the disclosure of (D1) by the separating means and by the means for by-passing some material directly to the clinkering furnace. As established in respect of Claim 1, the system consisting of the recirculation system comprising three conduits and of the separating means would not be arrived at by the skilled person in an obvious way.

Reasons for the Decision

1. The appeal is admissible.
2. *Article 123 EPC*
 - 2.1 Claim 1 differs in substance from Claim 1 as granted by the incorporation of the features according to the granted Claim 2 which is supported by the original Claim 3.

Claim 6 corresponds in substance to the granted Claim 7.

Claims 1 to 9 are not objectionable under Article 123(2).

- 2.2 The features incorporated into Claim 1 from the granted Claim 2 are of a character restricting the scope of protection so that Claim 1 satisfies the requirement of Article 123(3) EPC.

As Claims 2 to 9 are maintained unamended in substance they also meet the requirement of Article 123(3) EPC.

3. *Late-cited document (D5)*

In accordance with the jurisprudence of the Boards of Appeal, a late-filed prior art document will be taken into account only if it is more relevant for the decision to be taken than the prior art already on file.

In its communication dated 15 July 1997 (see section 5) the Board set out the reasons why it did not consider the disclosure of (D5) relevant. Since the Appellant at the oral proceedings did not rely anymore on arguments

based on (D5), it is not necessary to elaborate further on this issue. The Board has decided to disregard this document in accordance with Article 114(2) EPC.

4. *Novelty*

The question of novelty had not been set out as a ground of opposition. However, since this issue was discussed in the appeal proceedings (see Appellant's letter dated 13 February 1996, section 2 and Respondent's letter dated 22 August 1996, page 4, paragraph 1, and page 6) observations with regard to this issue are made in the following (see G 0007/95).

4.1 Claim 1

Claim 1 can be arranged in the following groups of features as submitted by the Appellant and accepted also by the Respondent (see Respondent's letter dated 22 August 1996):

Apparatus for producing cement clinker comprising

- (a) a preheater (1);
- (b) a calcining furnace means (2) having a material inlet (25) and a material outlet (22);
- (c) a clinkering furnace (30) having a material inlet (31) and a material outlet (32)
- (d) and a cooler (4)
- (e) wherein fuel is supplied to and combustion takes place within both of said calcining furnace (20) and said clinkering furnace (30) and cement raw meal is preheated in said preheater by means of

exhaust gases from at least one of said calcining furnace (20) and said clinkering furnace (30) and sequentially supplied from said preheater to said calcining furnace (20), clinkering furnace (30) and said cooler (4)

whereby there is provided

- (f) a riser duct (35) for supplying exhaust gas from the clinkering furnace (30) to the calcining furnace means (2);
- (g) means defining a first conduit (70, 75, 78, 71) for supplying calcined material from the material outlet (13) of calcining furnace means (2) to the material inlet of the clinkering furnace (30);
- (h) means for recirculating at least a portion of the cement raw meal from the material outlet (13) of the calcining furnace means (2) through the calcining furnace means before it is supplied to the clinkering furnace (30) including means defining a second conduit (70, 75, 76) flow connecting the material outlet (13) of the calcining furnace means (2) with the riser duct (35);
- (i) characterised by means defining a third conduit (71) for by-passing some material directly to the clinkering furnace (30) around said first and second conduits,
- (k) said second conduit being a fluidizing gravity conveyor;
- (l) wherein means (72) are associated with said second conduit (70, 75, 76) for separating coarse particles from the calcined material and

(m) wherein said third conduit (71) supplies said coarse particles directly to the clinkering furnace (30).

The nearest prior art is described by (D1). It is not in dispute between the parties that (D1) describes the features (a) to (h) and that the features (i), (k), (l) and (m) are not known therefrom.

4.2 Having regard to Claim 6, (D1) discloses neither means for by-passing material around the recirculating means and the discharging means nor means for separating coarse particles from the at least partially roasted fine grained material. The separating means (38, 39, 41) of (D1) relates to a valve, the position of which is controlled by pressure sensors (42, 43) provided in the riser duct (11). This known means separates the calcined material passing out from the cyclone (7) into two fractions on the basis of the mass flow quantity whilst the means (72) for separating coarse particles according to Claim 6 operates on the criterion of the size of the calcined particles. The means for separating coarse particles according to Claim 6 cannot, therefore, be equated with the separating means described in (D1).

4.3 It follows that the subject-matter of Claim 1 and Claim 6, respectively, is novel in the sense of Article 54 EPC.

Since the question of novelty was no longer disputed at the date of the oral proceedings, this issue requires no further consideration.

5. *Inventive step*

5.1 The problem to be solved by Claim 1 is to provide an apparatus for roasting fine grained material such as cement raw meal, lime or dolomite which will improve the operating characteristics of a recirculating calcining system. In particular, plugging of the recirculation system caused by large pieces of material should be avoided and the overall height of the apparatus should be small (see column 1, lines 33 to 54 and column 5, lines 20 to 38 of the description).

The arrangement of means for separating coarse particles from the calcined material in association with the first and the second conduits and the provision of a third conduit for by-passing the coarse particles directly to the clinkering furnace avoids blockage of the recirculation means whilst assuring the prevention of permanent recirculation of some material. The construction of the second conduit as a fluidizing gravity conveyor permits a low slope of the second conduit to be realized which leads to a reduction of the overall height of the apparatus.

The underlying problem with the two above-cited aspects is thus completely solved by the subject-matter of Claim 1 which is not put into question by the Appellant.

5.2 In his argumentation as to a lack of inventive step of Claim 1, the Appellant relied in the oral proceedings exclusively on the disclosure of (D1) in combination with the common knowledge of the person skilled in the art of calcining fine grained material.

The Board can follow the Appellant's argument that the problem of reducing the overall-height of the apparatus

of (D1) and in particular of the vertical distance between the inlet and the outlet of the recirculation duct (40) per se becomes evident from normal considerations such as matters of material savings and expense.

Contrary to the opinion of the Appellant, the substitution of a fluidizing gravity conveyor for the chute (40) of (D1) cannot, however be regarded as the only possible and thus obvious measure. The skilled person could select for example a mechanical conveyor, such as a scrape or a worm conveyor and would be motivated to do so, since with such a type of conveyor the danger of plugging of the ducts by coarse particles can be effectively avoided without taking further measures. Mechanical conveyors are also known to be appropriate in a high-temperature environment, which is demonstrated by the use for example of travelling or chain grates in furnaces.

In the Statement of Grounds of Appeal, the Appellant referred to page 220, Figure 1, of (D2) in the context of a fluidizing gravity conveyor. This citation describes a circulating fluidized bed reactor for raw meal calcination, the fluidizing air being the primary combustion air of the reactor. There is, however, no hint in (D2) that such a fluidizing bed should be used as a fluidizing gravity conveyor for the purpose of reducing the overall height of the calcinating apparatus.

Thus, the design of the second conduit as a fluidizing gravity conveyor cannot be regarded as a measure being obvious from the prior art or from common technical knowledge.

5.3 Assuming according to the reasoning of the Appellant, that the skilled person would for some reason choose to

provide a fluidizing gravity conveyor for the recirculation conduit (40) of (D1) and would subsequently be faced with the problem that large chunks of material threaten to obstruct the duct, he would have a number of choices to cope with this problem such as for example enlarging the material duct or providing means for crushing the coarse particles. He would rather be induced to avoid the provision of means for separating coarse particles from the calcined material as according to Claim 1, since this choice would result in the requirement of a further duct for conveying the coarse particles to the clinkering furnace. The provision of such means would, therefore, have to be regarded as non-obvious to the skilled person.

The separating means (38, 39, 41) of (D1) separates the calcined material exiting from the cyclone (7) on the basis of the mass flow quantity as already illustrated in section 4.2 above, whereas the separating means according to Claim 1 operates on the criterion of the size of the calcined particles. As the known means cannot effect the systematic separation of coarse particles from the calcined material, it cannot suggest means defining a third conduit for by-passing coarse particles directly to the clinkering furnace around the first and second conduits wherein means are associated with the second conduit for separating the coarse particles from the calcined material.

According to the Appellant's line of argument, the skilled person, after having replaced the separating means (38, 39, 41) of (D1) by means for separating coarse particles from the calcined material, would provide a third duct branching off from the recirculation conduit (40) and leading directly to the clinkering furnace in order to avoid permanent recirculation of the fine grained material. By such a

modification the material conduit (22) of (D1) would be given the function of a by-pass duct for transporting exclusively coarse particles to the clinkering furnace.

As explained in (D1) (see page 5, paragraphs 1 and 3, and page 14, paragraphs 2 and 3) the material mass flow directed to the furnace and the recirculation mass flow should be continuously mutually controlled. The combustion zone (37) serves as a buffer for varying material mass flows and the furnace (1) is provided with a constant mass flow of material. The repartition of the material mass flow leading to the furnace (1) and of the recirculation mass flow is regulated by the valve means (41) which is controlled by the duct pressure sensors (42, 43). It is clear from the above passages that in the system of (D1) the conduit (22) serves the purpose of delivering the calcined material to the inlet of the clinkering furnace, the mass flow in this conduit having to be adapted by the separating means (38, 39, 41) in accordance with the requirement of a constant material mass flow to the furnace. The elimination of this function and redefinition of the conduit (22) as a duct for transporting coarse particles of the calcined material to the clinkering furnace as proposed by the Appellant to be obvious for the skilled person, would deprive the known system of its original function so that its inherent problem of providing a constant material mass flow to the clinkering furnace could no more be solved.

The Board considers that the person skilled in the art would not modify a known apparatus such that it achieves an object fundamentally different from that originally provided whereby at the same time it can no longer perform the function for which it had been designed.

5.4 In the Statement of Grounds of Appeal the Appellant further referred to (D3) and (D4) stating that separation devices according to the invention are known from these citations.

Actually, (D3) and (D4) describe a process and means for separating coarse particles from fine-grained particles. The purpose of the process according to (D3) resides in avoiding differences with regard to the cooling of particles of different size and to obtain a more effective cooling of clinker of any particle size (see (D3), column 2, paragraph 2 and Claim 1).

(D4) deals with a process for recovering heat from grained hot material, the material being separated in groups comprising particles of different size and each of the groups being cooled by individually delivered gas streams (see (D4) page 6, paragraph 1 and Claim 1).

Neither (D3) nor (D4) gives any hint of separating grained material in respect of the particle size in order to avoid plugging of the recirculation system of the calcining apparatus.

The combination of the disclosure of (D3) or of (D4) with the teaching of (D1) can not, therefore, lead to the subject-matter of Claim 1 in an obvious way. Besides, (D3) and (D4) were not discussed by the Appellant in the oral proceedings before the Board.

5.5 Claim 6 differs from the disclosure of (D1) by the provision of means for by-passing material around said recirculating means and discharging means and of means for separating coarse particles from the at least partially roasted fine grained material and for discharging large particles through the by-passing means.

The inherent problem resides in improving the operating characteristics of the recirculating calcining system whereby in particular plugging of the recirculation system caused by large pieces of material is to be avoided.

As substantiated above in connection with Claim 1, none of the citations discussed suggests modifying the apparatus known from (D1) such that it comprises the above-cited distinguishing features.

5.6 Summarising, the solutions to the technical problem underlying the invention as defined in the independent Claims 1 and 6 involve an inventive step and therefore these claims as well as their respective dependent Claims 2 to 5 and 7 to 9, relating to particular embodiments of the invention, are allowable.

6. The patent description was amended to take account of the closest prior art as this is represented by (D1).

Furthermore, the description was brought into agreement with the subject-matter now claimed.

7. The grounds of opposition do not prejudice maintenance of the patent in amended form in accordance with the documents submitted at the oral proceedings.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent as amended with the documents submitted at the oral proceedings.

The Registrar:



N. Maslin

The Chairman:



C. Wilson

