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D E C I S I O N
of 27 June 1996

Case Number: T 0016/94 - 3.3.2

Application Number: 87302779.1

Publication Number: 0240304

IPC: C04B 7/43

Language of the proceedings: EN

Title of invention:
Plant for manufacturing cement clinker

Patentee:
KAWASAKI JUKOGYO KABUSHIKI KAISHA

Opponent:
Krupp Polysius AG

Headword:
Cement clinker/KAWASAKI

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0016/94 - 3.3.2

D E C I S I O N
of the Technical Board of Appeal 3.3.2
of 27 June 1996

Appellant: (Opponent)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 15 December 1993 concerning maintenance of European patent No. 0 240 304 in amended form.**

Composition of the Board:

Chairman: F. Antony
Members: G. J. Wassenaar
J. van Moer

Summary of Facts and Submissions

I. European patent No. 0 240 304 was granted in response to European patent application No. 87 302 779.1, filed on 31 March 1987. The mention of the grant was published in European Patent Bulletin 91/28 of 10 July 1991.

II. A Notice of Opposition was filed against the European patent by the Appellant (Opponent) on 9 April 1992. Revocation of the patent was requested on the grounds of lack of inventive step, unallowable extension and insufficient disclosure (Articles 100(a), (b) and (c) EPC), the latter two grounds being unsubstantiated in the Notice of Opposition.

The opposition was supported, inter alia, by the following documents:

JP-B-60-13738 (D1)
JP-B-60-13739 (D3).

III. In an interlocutory decision of 20 October 1993, issued on 15 December 1993, the Opposition Division held that the patent could be maintained in amended form on the basis of Claim 1 filed during oral proceedings on 20 October 1993 and reading as follows:

"1. A plant for manufacturing cement clinker comprising:
a suspension preheater (6) for preheating a cement material powder;
a spouted-bed type furnace (2, 80, 102) for granulating the preheated cement material powder, the spouted-bed type furnace (2, 80, 102) having a conical end portion (28) joined to a throat portion (32) for the introduction of combustion gas;

sintering means (4, 80) constituted by either the spouted-bed type furnace (80) or a fluidized-bed type furnace (4) for sintering the granulated cement material powder;
burner means (34) provided in the vicinity of the throat portion (32) of the spouted-bed type furnace (2, 80, 102) for forming a local hot region (38) in the spouted-bed type furnace (2, 80, 102) so that satisfactory granulation is obtained without the need to introduce seed particles;
a charging chute (40) provided slightly above the local hot region and adapted for charging the preheated cement material powder from the suspension preheater; and
a discharge chute (42) disposed on one side of the local hot region and adapted for discharging the cement raw material which has been at least granulated."

The amended Claim 1 was considered allowable according to Article 123(2) EPC. It was considered that its subject-matter was novel with respect to the above mentioned documents, which were regarded to represent the closest prior art. The subject-matter of the amended claim was also considered to involve an inventive step over the documents on file. The decision with respect to inventive step was based on the following reasons:

Because no plant for manufacturing cement clinker comprising a spouted-bed furnace is known from the available prior art, and no document has been submitted showing a throat portion with a burner in its vicinity, the replacement of a fluidized-bed (D3) or "jet-type" fluidized bed (D1) furnace by a spouted-bed reactor having burner means in the vicinity of its throat portion is not a routine procedure for the skilled person (point 6 of the reasons).

IV. An appeal against this decision was lodged by the Appellant on 11 January 1994. The Statement of Grounds was filed on 12 April 1994.

With the Statement of Grounds the Appellant cited a new document, viz.

"Powder Technology", 4 (1970-71), pages 269 to 274 (referred to as D7).

It was argued that this document should not be regarded as "late filed" because it related to limitations in the claims introduced during the opposition procedure, which the Appellant could not foresee within the time limit set for filing the Notice of Opposition. This document was considered very relevant because it would destroy the novelty of the main claim as allowed by the Opposition Division. It was further argued that if the subject-matter of Claim 1 would be regarded as novel over D7 it would certainly lack an inventive step over D7 in combination with D1 or D3.

V. With a counter-statement to the Notice of Appeal the Respondent (Proprietor) filed an amended Claim 1. It was submitted that its subject-matter was both novel and inventive.

VI. The Appellant objected to the said amended claim on the grounds that certain features of the amendment were not originally disclosed and that its subject-matter still lacked an inventive step over D7 in combination with D1 or D3. In a further letter another new document was cited, viz.

Mathur, Kishan, Spouted Beds, Academic Press, Inc. 1974, pages 200, 201, 294 and 295 (referred to as D8).

VII. After the summons for oral proceedings the Respondent filed a further amended Claim 1 as main request along with 18 auxiliary requests.

Claim 1 according to the main request reads as follows:

"A plant for manufacturing cement clinker comprising:
a suspension preheater (6) for preheating a cement material powder;
a spouted-bed type furnace (2, 80, 102) for granulating the preheated cement material powder, the spouted-bed type furnace (2, 80, 102) having a straight barrel portion (26) and a throat portion (32) for the introduction of combustion gas, the straight barrel portion (26) and the throat portion (32) being joined to respective ends of a conical end portion (28);
sintering means (4, 80) constituted by either the spouted-bed type furnace (80) or a fluidized-bed type furnace (4) for sintering the granulated cement material powder;
burner means (34) provided in the vicinity of the junction of the throat portion (32) and the conical end portion (28) of the spouted-bed type furnace (2, 80, 102) for forming a local hot region (38) in the spouted-bed type furnace (2, 80, 102) so that satisfactory granulation is obtained without the need to introduce seed particles;
a charging chute (40) provided slightly above the junction of the straight barrel portion (26) and the conical end portion (28) of the spouted-bed type furnace (2, 80, 102) and adapted for charging the preheated cement material powder from the suspension preheater; and
a discharge chute (42) provided slightly below the junction of the straight barrel portion (26) and the conical end portion (28) of the spouted-bed type furnace (2, 80, 102) and disposed laterally of the local hot

region and adapted for discharging the cement raw material which has been at least granulated."

VIII. In the oral proceedings, which were held on 27 June 1996 in the absence of the duely summoned Respondent, the Appellant only maintained the objection of lack of inventive step. Their arguments can be summarised as follows:

Claim 1 comprises two alternative plants: one in which a spouted-bed type furnace is only used as a granulator and the sintering takes place in a fluidized-bed type furnace; and another wherein granulation and sintering is performed in the same spouted-bed type furnace.

The closest prior art for both alternatives is represented by D7, which discloses a spouted-bed furnace for the sintering of cement raw material which, apart from the placing of the discharge chute, is identical to the spouted-bed type furnace as now claimed. Because of the location of the burners around the throat portion in the vicinity of the conical bottom part of the reactor corresponding to the arrangement shown in the patent in suit, a local hot region is automatically created. The only furnace feature of Claim 1 not disclosed in D7 is a discharge chute disposed laterally of the conical part.

Spouting-bed reactors having a laterally placed discharge chute are, however, known in the art. Whether a discharge through the throat portion for the introduction of combustion gas is chosen (as shown in D7) or a separate, laterally placed discharge chute (as now claimed) depends on the specific process requirements. Both options have their advantages and disadvantages. By a discharge through the throat the gas is cooled by the granules; therefore D7 shows additional burners in the lower part of the throat. The advantage

of such a discharge is however a more homogeneous product. Thus if homogeneity is deemed not so important it is obvious to choose the other option. That a lateral discharge chute was an obvious option follows also from D3, which discloses a lateral discharge chute in a fluidized-bed type reactor. A fluidized-bed type reactor is closely related to a spouted-bed type reactor, as illustrated by D1 disclosing a reactor which can be regarded as a hybrid of both types of reactors.

IX. The Appellant requested that the decision under appeal be set aside and the patent be revoked in its entirety.

The Respondent requested in writing that the decision under appeal be set aside and that the patent be maintained on the basis of Claim 1 according to the main request filed on 28 May 1996 or alternatively on Claim 1 according to any of the 18 auxiliary requests filed on the same date.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of recently filed evidence*

2.1 According to the Appellant, D7 should not be regarded as late filed evidence, because its relevance is related to amendments made by the Respondent during the opposition procedure. The Respondent has not objected to this view and has dealt with D7 as regularly filed evidence. Under these circumstances the Board sees no reason to question the Appellant's submission that D7 is not late filed

evidence, so that D7 is allowed in the proceedings and taken into consideration for judging novelty and inventive step.

2.2 With respect to the still later filed document D8 the Appellant has not given any reasons for filing the document at such a late stage. The Board considers D8 to be evidence not submitted in due time in the meaning of Article 114(2) EPC, which may be disregarded absent sufficient relevance to the decision. D8 discloses a spouted-bed type dryer and granulator but does not relate to the art of manufacturing cement clinker and does not relate to furnaces comprising burners. Hence D8 is disregarded.

Main request of the Respondent

3. *Allowability of amendments*

Amended Claim 1 differs from Claim 1 as originally filed in a more detailed specification of some of the construction elements of the plant. The added features are all based on the description and figures as originally filed (see page 11, lines 3 to 26) and do not extend the protection conferred by the patent specification. Present Claim 1 is therefore allowable under Article 123 EPC. In fact, no objections in this respect were raised by the Appellant towards present Claim 1.

4. *Novelty*

No document on file discloses a plant for manufacturing cement clinker having all the features of present Claim 1. Its subject-matter is therefore novel. The novelty of present Claim 1 was in fact not questioned by the Appellant.

5. *Inventive step*

5.1 The Board cannot accept Appellant's argument that D7 represents the closest prior art because it discloses an apparatus for manufacturing cement clinker comprising a spouted-bed type furnace which has more features in common with the furnace according to present Claim 1 than furnaces disclosed in any other document on file.

As already indicated in the contested decision, Claim 1 comprises two alternative embodiments, to wit

(a) a plant for manufacturing cement clinker comprising a spouted-bed type furnace for granulating the preheated cement raw material powder which also constitutes the sintering means for the granulated cement raw material (i.e. one furnace with a double function), and

(b) a plant for manufacturing cement clinker comprising

(i) a spouted-bed type furnace for granulating the preheated cement raw material powder and

(ii) a fluidized-bed type furnace for sintering the granulated cement raw material (i.e. two furnaces). In both embodiments a suspension preheater for preheating cement raw material powder is connected to the spouted-bed type furnace.

D7 discloses a laboratory scale experimental spouted-bed reactor for sintering decarbonated (calcined) cement raw material granules (paragraph 2, points A and B). The granules may also be preheated but it is not disclosed how that is done (paragraph 3C, page 272). D7 further

discloses that the experiments described suffered from appreciable losses of the feed, which was probably due to breakage of the granules, and that attempts to increase the strength of the granules by addition of clay were not successful (paragraph 3C, page 273). This information implies that the granules were made in a conventional laboratory scale granulator. Anyhow D7 does not disclose or suggest the use of a spouted-bed type furnace for granulating cement raw material powder. Since the latter is a central feature of the claimed invention the arrangement of Claim 1 is functionally essentially different from the arrangement disclosed by D7. However, not only is the function of the claimed plant elements essentially different, also the construction thereof is essentially different from the construction disclosed in D7. Explicitly disclosed in D7 is only a spouted-bed reactor with a cooling device (Fig. 1) and by implication a non-specified granulator, which is not connected with the reactor. Both alternative plants comprised by present Claim 1 differ therefrom essentially in that the spouted-bed type furnace is connected to a suspension preheater.

Therefore, despite of the similarities between the furnace disclosed in D7 and the furnace used in the plant according to present Claim 1, D7 does not represent the closest prior art.

The closest prior art should be sought amongst documents disclosing a plant for manufacturing cement clinker comprising a suspension preheater and a granulator. The only document on file disclosing such a combination is D1, already discussed in the patent in suit. The Board is, therefore, of the opinion that D1 represents the closest prior art.

5.2 D1 discloses a plant for manufacturing cement clinker, comprising a suspension preheater, a calcinator, a spouted-bed type granulator, a fluidized-bed type sintering furnace and a fluidized-bed type cooler. According to the acknowledgement of D1 in the present patent specification, either the granulation takes place only at a small rate and the granules formed tend to be too small and have non-uniform sizes, or the stability of the spouted-bed tends to be impaired due to agglomeration in the bed (column 2, lines 18-26).

In the patent specification it is stated that with the arrangement of the invention it has become possible to produce, stably and efficiently, cement clinker having uniform and large sizes generally between 2 and 3 mm, which would result in reduced power consumption for grinding the clinker, improved heat recovery efficiency in the cooling system and decreased total fuel consumption (column 3, lines 16-27).

These improvements have not been denied by the Appellant and the Board sees no reason to question them.

The technical problem underlying the invention can therefore be seen in providing a plant for producing cement clinker having uniform and relatively large size in a stable, efficient and more economic way.

The above-mentioned problem is solved by a plant having a spouted-bed type furnace of special construction for granulating the preheated cement raw material powder and sintering the granules as specified in Claim 1 according to alternative (a), or a plant having a spouted-bed type furnace of the same special construction for granulating the preheated cement raw material and a fluidized-bed type furnace for sintering the granules, according to alternative (b).

Since the above mentioned improvements appear credible, and in the absence of evidence to the contrary, the Board is satisfied that the claimed plant actually solves the above-mentioned technical problem.

5.3 It remains therefore to be decided if, for solving the above stated problem, it was obvious to replace the calcinator, the spouted-bed type granulator and the fluidized-bed type sintering furnace as disclosed in D1 by a single spouted-bed type furnace as defined in Claim 1 (alternative (a)); or to replace calcinator and spouted-bed type granulator disclosed in D1 with a spouted-bed type furnace as defined in Claim 1 (alternative (b)).

5.4 Alternative (a)

5.4.1 The spouted-bed type furnace of Claim 1 does not only differ from the spouted-bed type furnace of D1 in that it combines the function of a granulator with that of a calcinator and a sintering furnace, it is also of essentially different construction. The furnace of Claim 1 comprises the following features:

(i) burner means provided in the vicinity of the junction of the throat portion and the conical end portion for forming a local hot region,

(ii) a charging chute provided slightly above the junction of the straight barrel portion and the conical end portion adapted for charging the preheated cement raw material powder from the suspension preheater, and

(iii) a discharge chute provided slightly below the junction of the straight barrel portion and the conical end portion and disposed laterally of

the local hot region. None of these features is disclosed or suggested in D1.

5.4.2 Feature (i) is indeed disclosed in D7 in connection with a spouted-bed sintering reactor for sintering cement raw material granules. Although the forming of a hot region is not mentioned as a beneficial aspect of the reactor, the Board accepts the Appellant's contention that with the arrangement of the burners as shown in Fig. 1 of D7, the formation of a hot region is probably unavoidable. One of the advantages mentioned in D7 is that the product grains have a narrow size distribution, improving their grindability (paragraph 4). D7 thus relates at least partly to the problem underlying the claimed invention. The Board, therefore, accepts that the skilled man, trying to solve the above mentioned problem, would take the teaching of D7 into consideration.

5.4.3 According to the teaching of D7 the reactor is fed with decarbonated granules of 1 to 3 mm which are usually preheated (paragraph 2.A. and 3.C.). D7 does not disclose, however, that the spouted-bed type reactor is suitable for granulating preheated cement raw material. Thus if the teaching of D7 were to be applied for modifying the plant according to D1, the spouted-bed type furnace should be situated after the spouted-bed type granulator; i.e. it would replace the fluidized-bed type sintering furnace of D1. In this way an arrangement totally different from that required by present Claim 1 would be obtained.

5.4.4 The Board is unable to follow the Appellant's allegation that it would not make much difference whether the reactor of D7 is fed with granules or with powder and that the sintering process disclosed in D7 would also

work if the reactor were fed with preheated cement raw material powder.

According to D7 the cement clinker is removed from the reactor through the gas inlet tube underneath the conical part of the reactor. This is only possible in a selective manner if the original porous feed granules are sufficiently densified by the sintering process, as extensively explained in paragraphs 2 and 3 of D7.

D7 further reveals that a problem during the experiments was that appreciable losses of the feed occurred, due to breakage of the granules followed by carry-over of the dust, and that attempts to increase the strength of the granules by the addition of clay were not successful. This is a strong indication that the reactor of D7 would not work if fed with preheated powder.

It was therefore not obvious to replace the spouted-bed type granulator and the fluidized-bed sintering furnace of D1 with the spouted-bed type reactor of D7.

5.4.5 The spouted-bed type furnace according to Claim 1 furthermore differs from the reactor of D7 in feature (iii) mentioned in point 5.4.1. The Appellant's allegation that, spouted-bed type reactors with a discharge chute at one side of the cone being known, the situation of a discharge chute laterally to the hot region would just be one of the obvious alternatives available to the skilled man cannot be accepted either.

There is no document on file which would disclose a discharge chute disposed at the side of the cone of a spouted-bed type reactor suitable for granulating or sintering cement raw material. Moreover, since the gas stream through the gas inlet tube underneath the cone plays an essential role in the selective removal of the

densified clinker granules from the reactor according to D7, the skilled man would not take into consideration a discharge chute situated laterally of the local hot region where there is no such gas stream.

Thus even if the skilled man would have considered to replace the granulator and the sintering furnace of D1 by the spouted-bed type reactor of D7, he would not have arrived at a construction according to Claim 1 of the patent in suit.

5.4.6 D3 discloses, in a plant for manufacturing cement clinker, a fluidized bed sintering furnace having a discharge chute in its straight barrel portion. The furnace is fed with cement raw material particles from the calcinator, and with clinkered fine particles from the fluidized-bed type cooler acting as seed particles in the sintering furnace. Since D3 does not disclose the sintering of cement raw material granules, its teaching cannot be combined with the teaching of either D1 or D7. Anyhow, since D3 does not disclose a spouted-bed type furnace it could in no case give an incentive to replace the spouted-bed type granulator and the fluidized-bed type sintering furnace of D1 with a spouted-bed type furnace according to the patent in suit.

5.4.7 The other documents on file are still farther removed from the subject-matter of Claim 1 and cannot give any incentive for the claimed arrangement. In summary, the entire cited prior art does not render alternative (a) obvious.

5.5 Alternative (b)

According to alternative (b), the subject-matter of Claim 1 differs from D1 in that the calcining furnace and the spouted-bed type granulator are replaced by a

spouted-bed type furnace of specified construction. D1 itself contains no hint for such a replacement. Since, as indicated above, D7 neither discloses a spouted-bed type furnace as required by Claim 1, nor the use of a spouted-bed type furnace for granulating cement raw material powder, such a replacement does not follow from a combination of the teaching of D7 with that of D1. In fact, as indicated above, such a combination would result in a plant in which the fluidized-bed type sintering furnace of D1 was replaced by a spouted-bed-type furnace as disclosed in D7. The subject-matter of present Claim 1 according to alternative (b) would differ even more from such an arrangement than according to alternative (a), since in alternative (b) the sintering furnace continues to be a fluidized-bed type furnace.

As indicated earlier, the other documents on file are still farther removed from the subject-matter of the patent in suit than D1 and D7, and do not provide even the slightest pointer for replacing the calcining furnace and the spouted-bed type furnace of D1 with a spouted-bed type furnace of the construction as defined in Claim 1. The plant according to alternative (b) is therefore not obvious either.

5.6 In summary, the available prior art does not give the skilled man any incentive to solve the above mentioned technical problem by a plant as claimed in present Claim 1.

It follows from the foregoing considerations that the subject-matter of Claim 1 is not only new, but also involves an inventive step in the meaning of Article 56 EPC.

6. Since the Respondent's main request can be allowed there is no need to consider their auxiliary requests.

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 on the basis of Claim 1 according to the main request filed on 28 May 1996, with the description to be adapted thereto.

The Registrar: The Chairman:

P. Martorana F. Antony