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File Number: T 149/89 - 3.3.2

Application No.: 81 110 557.6

Publication No.: 0 054 314

Title of invention: A method and a plant for producing a dry cement
composition

Classification: C04B 22/14

D E C I S I O N
of 18 April 1991

Proprietor of the patent: Aktieselskabet Aalborg
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Opponent: Verein Deutscher Zementwerke e.V.

Headword: Cement Composition/AALBORG

EPC Art. 56

Keyword: "Inventive step (yes) - non-obvious process step against the trend"

Headnote



Case Number : T 149/89 - 3.3.2

D E C I S I O N
of the Technical Board of Appeal 3.3.2
of 18 April 1991

Appellant :
(Proprietor of the patent)

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Decision under appeal :
Decision of Opposition Division of the European
Patent Office dated 4 October 1988, posted on
22 December 1988 revoking European patent
No. 0 054 314 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : P.A.M. Lançon
Members : I.A. Holliday
E.M.C. Holtz

Summary of Facts and Submissions

- I. European patent No. 0 054 314 concerning a method and a plant for producing a dry cement composition was granted on the basis of eight claims in response to the European patent application No. 81 110 557.6.

The independent Claims 1 and 6 read as follows:

"1. A method of producing a dry cement composition, said method comprising feeding a continuous flow of a starting material (C, G), which includes cement binder clinker (C) and a content of water soluble chromate, to a cement mill (19-21), grinding the starting material in the cement mill while introducing a cooling medium into the mill so as to maintain the temperature of the material in the mill at a desired level, continuously discharging the ground cement material from the cement mill, and transferring the ground cement material to a storage container (33), characterized in that ferrous sulfate ($\text{FeSO}_4 \cdot n\text{H}_2\text{O}$) in an amount of 0.3-1 percent by weight is added to and mixed with said flow of material in a dry or non-dissolved condition and at a location or at locations upstream of said storage container (33) in order to eliminate or substantially reduce said content of water-soluble chromate.

6. A plant for carrying out the method according to any of the claims 1-5 which comprises at least one cement mill (19-21), feeding means (23,24) for feeding a continuous flow of a starting material (C, G), including cement binder clinker (C), to the mill, a storage container (33) for finished cement composition, transporting means (31) for transporting ground cement material discharged from the mill to the storage container (33), and metering means (15) for feeding a metered amount of ferrous sulfate (FS) into the flow of material at a location or at locations

upstream of the storage container, characterized in first measuring means (23' 24') for measuring the mass flow of the starting material (C, G) supplied to the cement mill (19,21) by the feeding means (23,24), second measuring means (25) for determining the mass flow of the ferrous sulfate (FS) continuously fed by the metering means (15) to the flow material, and in control means (16) for controlling the feeding rate of the metering means (15) in relation to the feeding rate of the feeding means (23',24') in response to measuring signals received from said first and second measuring means, so as to add ferrous sulphate to the material flow in an amount of 0.3-1 percent by weight."

- II. The Opponent (Respondent) filed a notice of opposition against the European patent requesting revocation of the patent on the grounds that its subject-matter lacked novelty and inventive step.

Five prior art documents were cited in support of the opposition:

- (1) CH-PS 534 634
- (2) Contact Dermatitis 1979, 39-42
- (3) US-PS 3 425 892
- (4) Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete 1980, 625-628
- (5) Acta Dermatovener (Stockholm) 53, 1973, 267-270.

- III. The Opposition Division revoked the European patent on the ground that the subject-matter of Claim 1 of the patent in suit was novel but lacked inventive step. Document (4) was considered to be the closest state of the art and was concerned with laboratory experiments in which ferrous sulphate was added to aqueous cement mixtures in a variety of ways each of which gave rise to a reduction of the

content of hexavalent chromic ions. Document (4) also contained a suggestion that experiments should be carried out on adding FeSO_4 directly to cement klinker in the cement mill. Although experiments by Fregert et al, document (2) had shown that spraying aqueous FeSO_4 into the cement mill did not lead to an acceptable reduction of the Cr^{6+} ion concentration, in the opinion of the Opposition Division, this would not have discouraged the skilled man from attempting addition in the solid state to the mill, especially since document (3) had shown that such addition was feasible.

- IV. The Appellant (Proprietor of the patent) lodged an appeal against this decision. In the Statement of Grounds of Appeal and during the oral proceedings held on 18 April 1991, the Appellant sought to introduce twelve further documents most of which were based on results of the research of Fregert and co-workers, the authors of documents (2) and (5) referred to above.

The arguments of the Appellant, both in the written procedure and at the oral proceedings, may be summarised as follows:

The Appellant argued principally along the same lines as set out in the opposition procedure. In particular, he stated that the Opposition Division had used hindsight in reaching its conclusion. The statement in (4) concerning adding FeSO_4 directly to the cement mill added nothing to an earlier disclosure of Fregert, document (5) which indicated that studies were in progress at least seven years before the priority date of the disputed patent into the feasibility of adding FeSO_4 to the cement mill. It was, however, apparent from document (2) that Fregert and his co-workers had reached the conclusion that the best way to add the FeSO_4 was to aqueous concrete mixtures. The

Appellant considered that document (3) was not relevant. Not only was it concerned with a different problem, retarding the setting time of the cement, in which the presence of the sulphate ion was the significant factor, but it was not clear from the disclosure of (3) that the FeSO_4 had been added in a dry or non-dissolved condition.

To support his argumentation that the prior art led the person skilled in the art away from the method and plant proposed by the invention, the Appellant presented the series of new documents by way of a historical review and concluded that in 1977 there was a clear cut off in any practical hope of eliminating the chrome content during the cement production in the mill. Additionally, in order to demonstrate the success of the invention, the Appellant referred to post-published documents indicating that the prevalence of chromate allergy and hand eczema among workers in daily contact with wet cement had declined significantly 6 years after the chromate content of Danish cement had been reduced according to the method of the patent in suit.

V. In a letter dated 6 September 1989, the Opponent (Respondent) filed counter-arguments and requested that the decision of the Opposition Division be confirmed. However, in a further letter dated 22 March 1991, the opposition was withdrawn.

VI. The Appellant requested that the decision of the Opposition Division be set aside and the patent maintained in the form as granted.

Reasons for the Decision

1. The appeal is admissible.

2. There are no formal objections to the present claims under Article 123 EPC since they are supported by the original disclosure and do not extend the protection conferred. Thus, Claim 1 represents a combination of Claims 1 and 4 as originally filed; Claim 2 comprises a preferred percent by weight range according to Claim 4 as originally filed; Claims 3 to 5 are based on Claims 5 to 7 as originally filed and the description on page 4, lines 21 and 28 and page 5, line 1; Claim 6 represents a combination of Claims 8 and 12 as originally filed; Claims 7 and 8 correspond to the originally filed Claims 10 and 11.
3. The Board has considered whether it should disregard the series of late filed documents in accordance with Article 114(2) EPC.

However, the new documents merely help to demonstrate that the results obtained by Fregart and co-workers, referred to in document (2), appear not to have been questioned by those skilled in the art. Thus, since the submission merely confirms evidence already on file, the Board has decided to accept the new documents in the context of the historical review referred to above (cf. decisions T 322/87, dated 25 April 1990, Reasons, point 6.2.2 and T 324/88 dated 8 February 1989, Reasons, point 5; neither published in OJ EPO).

4. The patent in suit is concerned with a method of producing a dry cement composition and a plant for carrying out the said method.
 - 4.1 In the opinion of the Board, the closest state of the art is considered to be document (2) which is also concerned with the reduction of water soluble chromate in cement in order to reduce the hazard of cement dermatitis. According

to (2) the reduction of chromate is carried out by adding an aqueous solution of ferrous sulphate or solid ferrous sulphate to cement. The test results show a complete reduction of the chromate. However, it is well-known to those skilled in the art that the addition of ferrous sulphate when the concrete is made, for example, at the building site, involves certain risks. It may happen that the building workers forget to add the ferrous sulphate or add an incorrect amount. Document (2) refers also to preliminary studies in which ferrous sulphate was sprayed into the hot and humid clinker and gypsum in the cement mill. In this context it is indicated that "hardly any chromate was then reduced, even if double the dose of iron sulphate was added". To verify this statement, the authors of (2) have carried out experiments simulating the conditions in the cement mill. As a result the chromate content was reduced at most by 74%, i.e. an undesirable amount still remained.

- 4.2 In the light of the said prior art, the technical problem underlying the patent in suit can be seen in providing an improved foolproof method and/or plant for producing a dry cement composition. In view of the situation at building sites, a need exists for such a safe method.

This problem is solved by the method and plant according to present Claims 1 and 6.

Having regard to the reducing capacity values which can be deduced from the Tables of the patent in suit in comparison with the reducing capacity values which appear in document (2), the Board is satisfied that the problem has been solved in a plausible manner.

5. After examination of the cited prior art, the Board has reached the conclusion that the claimed subject-matter is

novel. Since novelty is not now disputed, it is no longer necessary to consider this matter in detail.

6. It remains to be considered whether or not independent Claims 1 and 6 satisfy the requirements of Article 56 EPC in respect of inventive step.

6.1 The method of Claim 1 of the patent in suit differs from that disclosed in (2) in that ferrous sulphate is added to the flow of cement material in a dry or non-dissolved condition at a location upstream of the storage container for said material. As indicated above, the authors of document (2), aware of the fact that elimination of water-soluble chromate in cement would decrease the frequency of cement dermatitis, have investigated different ways of mixing ferrous sulphate at different stages (locations) during cement processing. The investigations concern in particular: (i) reduction of chromate in cement by aqueous solution of pro analysi ferrous sulphate; (ii) reduction of chromate in cement by solid pro analysi ferrous sulphate; (iii) reduction of chromate in cement by stored aqueous solution of pro analysi ferrous sulphate; (iv) reduction of chromate in cement by technical ferrous sulphate; (v) reduction of chromate in cement by aqueous solution of ferrous sulphate in the presence of sand; and (vi) reduction of chromate by ferrous sulphate in hot cement. Of this group of investigations only the last can be regarded as being significant for the addition of ferrous sulphate upstream of the storage container for the ground cement material as required by the present Claim 1.

Said investigation comprises two experiments simulating the conditions in the cement mill, firstly in which clinker, gypsum and a solution of iron (ferrous) sulphate were heated to 140°C and the sample was then milled, and

secondly in which clinker and gypsum were heated to 140°C after milling and the solution of iron (ferrous) sulphate was sprayed onto the hot sample. The reducing capacities were 28% and 74% respectively (cf. page 40).

On the basis of these investigations, the authors of (2) came to the conclusions: (i) that due to the hot and humid conditions in the mill the ferrous sulphate lost at least some of its reducing capacity; (ii) the best way to add ferrous sulphate would be first to dissolve it and then to add the solution when concrete or mortar is mixed. Accordingly, document (2) gives a clear teaching to add the ferrous sulphate downstream of the storage container in a dissolved condition (cf. page 41, right column), and, accordingly, does not point to the solution claimed in the patent in suit.

6.2 Document (4) discloses laboratory investigations similar to those of (2). The test results presented in (4) also demonstrate the possibility of adding the ferrous salt in a solid or dissolved condition to the cement, cf. page 626, left column, last paragraph. On closer analysis of the test series, the skilled person gains the impression that ferrous sulphate in aqueous solution is particularly recommended since there appears to be no problem with a homogeneous distribution of the reducing agent and ferrous sulphate in dissolved condition shows a higher reducing capacity.

In the light of this teaching, the skilled person would be discouraged from adding solid ferrous sulphate to a cement mill even if the prior art did not exclude such a process step.

In the Board's opinion, the Appellant is therefore correct in his contention that the statement in (4) on page 627, left column, last paragraph

"Zu klären ist die Frage, ob das Reduktionsmittel bereits beim Vermahlen des Zementklinkers zur Herstellung Chrom-(VI)-armer Zementsorten beigemischt wird - entsprechende Mahlversuche mit Zementklinkern unter Zusatz von Eisen (II)-Sulfat stehen noch aus - oder bei der Betonherstellung im Anmachwasser dosiert wird."

adds nothing to the same statement by Fregert et al, seven years earlier in document (5).

- 6.3 Document (1) can be regarded as a fundamental disclosure of how to eliminate the chromate content of cement by using different reducing agents. This prior art comprises a list of ten reducing agents amongst which ferrous sulphate is quoted in an amount of 0.1%, compared with 0.3-1% according to the patent in suit.

Although (1) indicates the addition of reducing agent during the cement production either to the clinker or to the grinding mill or to the gypsum, there is, however, no concrete statement about the physical conditions of the reducing agent. Thus, the skilled person also aware of the disclosures in (2) and (4) and the bibliographical references of both, would have no real incentive to carry out the method according to present Claim 1. As discussed above, the relevant prior art comprises a variety of ways in which one might add the reducing agent upstream or downstream of the storage container to the cement material whereby the kind of salt, the physical conditions and the procedure of admixture (introduction) may be changed.

- 6.4 Document (3) is concerned with an unrelated problem, i.e. a method for producing a cement mixture having a reduced hardening rate. Although this prior art teaches that ferrous sulphate can be added to Portland cement binder clinker prior to grinding and can be thoroughly mixed with the cement component during the grinding step, there is not the slightest hint in this document that the water soluble chromate in cement might be reduced. Thus, the results quoted in (3) with respect to the hardening rate of cement are in no way related to the method according to present Claim 1.
- 6.5 In summary, although it might seem with hindsight obvious in producing a dry cement composition to add ferrous sulphate upstream of the storage container to the cement material, as is done in (3) and (1) and indicated as a possibility in (2) and (4), none of these documents alone or in combination with the other prior art disclosure gives the skilled person a clear teaching to add the ferrous sulphate in a dry or non-dissolved condition. In the present case, in particular with respect to the historical review and the explanations regarding the particular field of the cement industry, presented by the Appellant's experts during the oral proceedings, the Board is satisfied that the trend at the priority date of the patent in suit was to add ferrous sulphate in dissolved condition to the cement when seeking to reduce the content of water soluble chromate.
- 6.6 It follows from the preceding paragraphs that the subject-matter of Claim 1 would not have been obvious in the light of the prior art. Thus the required inventive step is not lacking and the requirements of Article 56 EPC are satisfied.

6.7 The same applies to Claims 2 to 5 which relate to particular embodiments of the method according to Claim 1.

6.8 The above findings also show that the plant (apparatus) according to Claims 6 to 8 are in no way rendered obvious by the available prior art.

These claims also involve an inventive step, especially since there was no specific attack on the apparatus claims during the appeal 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 granted.

The Registrar:

The Chairman:

P. Martorana

P.A.M. Lançon