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File Number: T 510/89 - 3.2.2

Application No.: 84 107 897.5

Publication No.: 0 132 654

Title of invention: Two stage batch liquefaction process and apparatus

Classification: C03B 3/00, C03B 5/235, C03B 5/12, C03B 5/14

D E C I S I O N
of 12 December 1991

Applicant: PPG Industries, Inc.

Headword:

EPC Articles 56 and 111(1)

Keyword: "Inventive step - remittal to Examining Division after substantial amendment"

Headnote

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 510/89 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 12 December 1991

Appellant : PPG Industries, Inc.
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Decision under appeal : Decision of Examining Division of the European Patent Office dated 9 March 1989 refusing European patent application No. 84 107 897.5 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : P. Dropmann
Members : W.D. Weiß
C. Holtz

Summary of Facts and Submissions

I. European patent application No. 84 107 897.5 filed on 6 July 1984 and published under publication No. 0 132 654 was refused by the Examining Division in a decision dated 9 March 1989. The decision was based on Claims 1 to 17 filed with the letter of 21 October 1987.

II. According to the decision, the subject-matter of the independent Claims 1 and 12 did not involve an inventive step in the light of a combination of the disclosures of documents EP-A-0 071 110 (D1) and US-A-3 607 190 (D2). In addition, it was objected that Claims 12 and 15 did not specify all the essential features of the invention.

III. A Notice of Appeal was filed against this decision on 2 May 1989, the appeal fee being paid on the same day. The Statement of Grounds of Appeal was received on 7 July 1989.

IV. Oral proceedings were held on 12 December 1991. In the course of these proceedings, the Appellant finally presented a single amended set of Claims 1 to 13 replacing all previous sets of claims.

Independent Claims 1 and 11 read as follows:

"1. Method of liquefying pulverulent batch materials in a liquefying vessel (12) by depositing through an opening (47) in a lid (43) covering the liquefying vessel (12) batch materials which have been preheated by heat recovery from an exhaust gas stream onto a stable layer (53) of batch surrounding a cavity within the liquefying vessel (12), providing heat of combustion to the cavity of the liquefying vessel (12) by means of substantially nitrogen-free

combustion of fuel with oxygen to liquefy the deposited batch materials and to permit the liquefied batch to flow over the stable batch layer (53) to an exit opening (41, 42) from the liquefying vessel (12), controlling the rate at which the batch materials are fed into the liquefying vessel (12) so as to maintain the stable batch layer substantially constant,

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passing pulverulent batch materials into a preheating vessel (10), in the preheating vessel (10) directly exposing the batch materials to said exhaust gas stream while agitating the batch materials so as to heat the batch materials, passing the heated batch materials from the preheating vessel (10) through a batch feed chute (50) positioned in said opening (47) into the liquefying vessel (12) when melting of the batch has begun but before substantial adherence between batch particles has developed, and passing the exhaust gas stream from the liquefying vessel (12) into the preheating vessel (10) through an exhaust duct (48) extending from said opening (47) and having a nose piece (61) directing the exhaust gas into an upper portion of the preheating vessel (10) away from the batch materials and shadowing the preheating vessel (10) from radiant heat transfer from the liquefying vessel (12), and using all of the high temperature products of combustion passed from the liquefying vessel (12) to the preheating vessel (10) as the only source of heat for preheating by said exhaust gas at a relatively slow rate so as to maximise transfer of heat from the exhaust gas to the batch materials, and discharging the exhaust gas from the preheating vessel (10).

11. Apparatus for liquefying pulverulent batch materials for carrying out the method of claim 1, comprising as liquefying vessel (12) a heated cavity encircled by a stable layer (53) of batch materials and having an upper inlet opening (47) in a stationary lid (43) covering the liquefying vessel (12) for depositing batch materials onto the stable batch layer (53) and a lower outlet opening (42) for draining liquefied batch from the liquefying vessel (12) which is mounted for rotation about a substantially vertical axis,
c h a r a c t e r i z e d i n t h a t
the apparatus further comprises as preheating vessel a rotary kiln (10) comprising an elongated inclined cylindrical vessel mounted for rotation about its cylindrical axis, means (13, 14) for feeding batch materials to a first end of the rotary kiln (10) and the batch liquefying vessel (12) being positioned at the opposite end of the rotary kiln for depositing batch materials from the rotary kiln (10) into the liquefying vessel (12), and a transition is provided between the rotary kiln (10) and the liquefying vessel (12) comprising a batch chute (50) positioned in said opening (47) and having a pivotable baffle (71) positioned at the exit end of the chute (50), and a nose piece extension (61) of an exhaust duct (48) wherein the nose piece (61) is positioned so that it directs the exhaust gases into an upper portion of the rotary kiln (10) away from the batch materials (60) and serves to shade the rotary kiln (10) from radiant heat transfer from the liquefying vessel (12) and said exhaust duct (48) extending from said opening (47) in the lid (43)."

V. The Appellant argued in support of these claims that it was not obvious in the light of the prior art documents

cited in the search report and in the application to use the whole volume of exhaust gas produced by nitrogen-free combustion of fuel with oxygen in the liquefying vessel as the only source of heat for preheating the batch materials by direct contact between the exhaust gas and the batch materials without causing dusting problems and blowing of the batch particles out of the preheating vessel or completely melting the particles and developing adherence between them in the preheater. Furthermore, it was not obvious to pass the exhaust gas from the liquefying vessel into the preheating vessel through a specific transition means provided between these vessels and to pass the preheated batch materials from the preheating vessel through a batch feed chute into the liquefying vessel, said transition means extending from and said chute being positioned in the same opening in the lid covering the liquefying vessel.

VI. The Appellant requests that the decision under appeal be set aside and a patent be granted on the basis of the set of claims submitted during the oral proceedings.

Reasons for the Decision

1. The appeal is admissible.

2. Formal aspects

2.1 The amended claims meet the requirements of Article 123(2) EPC. In particular, the feature of Claim 1, concerning preheating at a relatively slow rate by said exhaust gas so as to maximise transfer of heat from the exhaust gas to the batch materials, has its basis on page 9, lines 19 to 21 of the description as originally filed. The features of Claims 1 and 11 relating to the batch feed chute, the

exhaust duct, the nose piece and the opening are disclosed on pages 16 (lines 12 to 15), 21 (lines 20 to 26) and 22 (lines 7 to 10) of the original description. The deletion in the present Claim 1 of the final feature of Claim 1 as originally filed ("discharging ... after the exhaust gas temperature is below the dew point of water vapor in the exhaust gas stream") is justified in view of the statements in the original description on page 7, line 5 ("can be reduced to the dew point") and page 24, line 14 ("the exhaust gas left the rotary kiln at 246°C"). Likewise, Claim 8 is admissible under Article 123(2) EPC in view of the original Claim 8 that does not necessitate the presence of auxiliary burners which are now excluded from Claims 1 and 8 ("as the only source of heat for preheating").

2.2 The Board is of the opinion that the present independent Claims 1 and 11 specify all the essential features of the invention. Indeed, method Claim 1 mentions the feature that all of the high temperature products of combustion are used as the only heat source for direct preheating all of the batch materials and apparatus Claim 11 contains the corresponding structural features and specifies, by reference to Claim 1, those features necessary to obtain the balanced operation.

2.3 Independent Claims 1 and 11 are correctly delineated over the prior art as known from document D1. All the features mentioned in the precharacterising portion of Claim 1 are, in combination, known from this document and the same applies to Claim 11. In particular, the teaching of this document comprises the preheating of particulate batch materials by heat recovery from an exhaust gas stream (cf. page 8, lines 26 to 30) and the provision of heat of

combustion to the cavity of the liquefying vessel by means of substantially nitrogen-free combustion of fuel with oxygen (cf. page 21, lines 4 to 15).

3. Novelty

The examination of the documents cited in the search report and in the description has revealed that the method and apparatus according to Claims 1 and 11, respectively, are not disclosed in any of them. It follows that the method and apparatus are novel over these documents within the meaning of Article 54 EPC. Since this was not challenged, it is not necessary to enter into details.

4. Inventive step

4.1 As acknowledged by the Appellant, document D1 represents the state of the art which is closest to the subject-matter of Claims 1 and 11.

4.2 The objective technical problem to be solved over the closest state of the art is to be seen in the provision of a method of and an apparatus for liquefying pulverulent batch materials which method and apparatus are more efficient than the method and apparatus disclosed in document D1. In addition, uneven melting in the liquefying vessel should be avoided.

This problem is solved by the method and apparatus according to Claims 1 and 11, respectively.

4.3 The features of the characterising portions of these claims may be subdivided into a first group of features concerning the preheating of the batch materials by the exhaust gas, and a second group of features relating to the transition of the preheated batch materials from the

preheating to the liquefying vessel, the transition of the exhaust gas stream from the liquefying to the preheating vessel and the shadowing of the preheating vessel from radiant heat transfer.

4.4 No inventive step can be seen in the first group of features for the following reason.

Document D1 (cf. in particular Claim 1, page 8, last paragraph, page 21, first paragraph, and Figure 6) discloses, in addition to the features specified in the preamble of Claim 1, that "the ability to use dry batch means that preheated batch may be fed to the process" and that "if the batch if preheated by heat recovery from the exhaust gas stream, substantial energy savings can be attained" (cf. page 8, lines 25 to 28).

Thus, document D1 teaches **preheating of the batch materials by heat recovery from the exhaust gas stream**, i.e. the exhaust gas stream produced by combustion within the liquefying vessel. Furthermore, it is stated in this document "that the process can accommodate preheated, dry, particulate batch, whereas prior art proposals to recover waste heat by preheating batch have usually been tied to the use of agglomerated batch" (cf. page 8, line 28 to page 9, first line). It follows from this statement and comparison of the process with the prior art proposals that agglomeration of the batch materials is not required for preheating of particulate batch materials by the exhaust gas stream and that preheating may be carried out by direct contact between the exhaust gas and the batch materials, otherwise the mentioning in the prior art proposals of the agglomerating step, which serves to avoid entrainment of fine batch materials in the gas stream, in contrast to the use of preheated particulate batch in the process described in document D1, would not make sense.

In view of the further statement in document D1 (cf. page 21, lines 4 to 15) that the use of oxygen as a partial or total replacement for combustion air in the described process is advantageous "for the sake of reducing the volume of combustion gases, thereby decreasing any tendency of the fine batch materials to become entrained in the exhaust gas stream" and that "this is particularly significant in the preferred practice of feeding the batch dry to the liquefaction vessel", it appears to be obvious to use all of the high temperature products of combustion as source of heat for directly preheating the batch materials without taking the risk of entrainment of the fine batch materials in the exhaust gas stream.

Furthermore, no inventive step appears to exist in the feature of Claim 1 that the combustion products from the liquefying vessel are the only source of heat for preheating. Indeed, the relevant parts of document D1 (cf. page 8, lines 25 to 31) do not mention any other means for preheating. In view of the teaching of document D1, the person skilled in the art would at least have made an experiment to find out whether or not all of the exhaust gases could have been used as the only source of heat for preheating as is already suggested in said document.

Hence, solely on the basis of the disclosure of reference D1, the Board cannot accept the Appellant's arguments in the Statement of Grounds concerning the matching of the exhaust gas volume to the mass throughput of batch, including the alleged numerous possibilities that might have prevented this matching when preheating was combined with the liquefier, and the surprising result as well as the considerations concerning the conventional heat recovering means.

The Appellant argues that the use of the exhaust gas stream from the liquefying vessel as the only source of heat for preheating is not obvious since document D2 teaches that preheating of batch materials necessitates a gas burner located at the discharge end of a rotary inclined preheater kiln (cf. Figure 1). This argument, however, is not convincing. As clearly stated in column 6, lines 26 to 34 of this document, said gas burner may be replaced by another gas burner (cf. Figure 1, reference numeral 79) positioned directly through the sidewall of the furnace for combustion above the batch blanket. Combustion gases from the latter burner serve to heat the batch blanket as well as to preheat the batch in the preheater kiln, in combination with the effluent carbon dioxide gases from the batch, in a similar manner as used in the method according to Claim 1.

Document D2 further discloses that the preheated batch is discharged from the rotary inclined preheater kiln into the furnace in substantially granular form after fusion has started but before substantial fusion would take place (cf. column 6, lines 65 to 69). Thus the feature of Claim 1 that the heated batch materials are passed from the preheating into the liquefying vessel when melting of the batch has begun but before substantial adherence between batch particles develops, does not render the claimed method inventive.

In view of the above, the first group of features concerning the preheating of the batch materials is obvious in the light of a combination of documents D1 and D2 and therefore is considered as contributing nothing to a possible inventive step in Claim 1 and, for the same reason, in Claim 11.

4.5 The second group of features of Claims 1 and 11 relates to the transition of the preheated batch from the preheating to the liquefying vessel and of the exhaust gas from the liquefying to the preheating vessel through the same opening in the lid covering the liquefying vessel and the shadowing of the preheating vessel from radiant heat transfer from the liquefying vessel.

These features were not part of the claims or recognisable in the description as relevant at the time when the search examiner carried out the search. Since the Board is hesitant to regard these features as obvious per se, it appears that a further search and subsequent substantive examination by the Examining Division are necessary for these features. This search should not be restricted to subclass C03B of the International Patent Classification.

It is therefore considered appropriate to set aside the decision under appeal and, in the exercise of the Board's discretion under Article 111(1) EPC, to remit the case to the Examining Division for further prosecution.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division for further prosecution on the basis of the set of claims submitted during the oral proceedings.

The Registrar: The Chairman:

N. Maslin P. Dropmann

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