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D E C I S I O N
of 29 May 1996

Case Number: T 0121/94 - 3.2.3

Application Number: 88305589.9

Publication Number: 0296773

IPC: F23K 3/02

Language of the proceedings: EN

Title of invention:

Method of operating a system for burning pulverised fuel

Applicant:

AIR PRODUCTS AND CHEMICALS, INC.

Opponent:

Thyssen Stahl AG

Headword:

-

Relevant legal provisions:

EPC Art. 56, 123(2)

Keyword:

"Inventive step - denied (main request)"

"Amendments - added subject-matter - yes (auxiliary request)"

Decisions cited:

T 0170/87

Catchword:

-



Case Number: T 0121/94 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 29 May 1996

Appellant:
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 18 November 1993,
posted on 16 December 1993, revoking European
patent No. 0 296 773 pursuant to Article 102(1)
EPC.

Composition of the Board:

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

Summary of Facts and Submissions

- I. European patent application No. 88 305 589.9, filed on 20 June 1988 and published on 28 December 1988 under publication No. 0 296 773 B1, was granted on 8 January 1992.

Claim 1 as granted reads as follows:

"A method of operating a system for burning pulverised fuel, which system comprises an oxy-fuel burner (10), means (11) for delivering oxygen to said oxy-fuel burner (10), and a dense phase material flow transport system (2) for delivering pulverised material to said oxy-fuel burner (10), characterized in that said dense phase material flow transport system (2) is delivering between 20 and 30 kg of pulverised material to said oxy-fuel burner (10) per 1 kg of propellant whereby substantially complete combustion takes place without the necessity of adding fuel gas to the burner."

- II. The patent was opposed by the Respondent who requested revocation of the patent on the grounds of Article 100(a) in the light of the following documents:

(D1) GB-A-2 146 758

(D2) "Stahl und Eisen", 105 (1985), No. 4, pages 211 to 220

(D3) "Neue Hütte", 1983, pages 441 to 444

(D4) "Stahl und Eisen", 105 (1985), No. 25 to 26, pages 1437 to 1441

(D5) "Das GSP-Verfahren, Entwicklungen zur Druckvergasung von staubförmigen Brennstoffen in der DDR", 1985, Brennstoffinstitut Freiburg.

In the written decision dated 16 December 1993 revoking the European patent the Opposition Division found that the subject-matter of Claim 1 did not meet the requirement of Article 56 in conjunction with Article 52(1) EPC.

III. The Appellant (Patentee) lodged an appeal against this decision on 15 February 1994 paying the appeal fee on the same day. The Statement of Grounds of Appeal was filed on 19 April 1994.

IV. In the Communication pursuant to Article 11(2) RPBA dated 15 May 1996, the Board pointed out that the document US-A-4 241 673 cited in the search report appeared also to be relevant since it taught that adding fuel gas to the burner of pulverised fuel was only necessary, if at all, during start-up, but not in the operational phase of the furnace.

Further according to the Board's communication, the following questions would appear to be relevant to the issue of inventive step:

1. In the context of the present patent, is the use of a lance in a method of operating a system for burning pulverised fuel equivalent to the operation of an oxy-fuel burner?
2. Did there exist a prejudice in the prior art such that with dense phase material flow transport systems a substantially complete combustion would require adding fuel gas to the burner?

- V. Oral proceedings were conducted on 29 May 1996 in which the Appellant requested to set aside the contested decision and to maintain the patent in the version as granted (main request) or on the basis of Claims 1 to 10 submitted on 24 May 1996 (auxiliary request).

The independent Claims 1 and 6 according to the Appellant's auxiliary request read as follows:

"1. A method of burning pulverized fuel, which method comprises the steps of:-

- (a) delivering oxygen to an oxy-fuel burner,
- (b) delivering said pulverized fuel to said oxy-fuel burner via a dense phase material flow transport system,
- (c) forming a mixture of oxygen and pulverized fuel, and
- (d) burning said mixture downstream of said oxy-fuel burner,

characterized in that said dense phase material flow transport system delivers from 20 to 30 kg pulverized material to said oxy-fuel burner per 1 kg of propellant whereby substantially complete combustion can be maintained without the necessity of adding external heat or fuel gas to said oxy-fuel burner."

"6. A method of recovering ash from pulverized fuel, which method comprises the steps of:-

- (a) delivering oxygen to an oxy-fuel burner,
- (b) delivering said pulverized fuel to said oxy-fuel burner via a dense phase material flow transport system,
- (c) forming a mixture of oxygen and pulverized fuel,
- (d) burning said mixture downstream of said oxy-fuel burner, and
- (e) recovering the ash formed in step (d)

characterized in that said dense phase material flow transport system delivers from 20 to 30 kg pulverized material to said oxy-fuel burner per 1 kg propellant whereby substantially complete combustion can be maintained without the necessity of adding external heat or fuel gas to said oxy-fuel burner, and in that said ash is substantially carbon-free."

VI. The arguments of the Appellant forwarded in writing and in the oral proceedings in support of his requests can be summarised as follows:

The invention differs from the closest prior art according to (D1) in that the pulverised fuel is transported to the burner at a rate of 20 kg to 30 kg per kg of propellant and complete combustion takes place without the necessity of adding fuel gas to the burner. The claimed range is remote from that of (D1) and in an area where the use of supplementary fuel could have been expected together with the formation of carbon-ridden clinker.

It is not disputed that it is known to supply a rate of 20 kg to 40 kg of dust per kg of propellant to a lance. Lancing is a technique whereby a jet of fine coal particles is introduced into an area of a furnace which is already undergoing intense combustion. This is clearly distinguished from a burner which is intended to provide a stable flame. A lance cannot, therefore, be equated with a burner.

Furthermore, it is inconceivable that had the inventors of (D1) appreciated that complete combustion and clinker-free firing could be obtained at the Patentee's range they would not have mentioned such a major technical breakthrough.

It is of particular importance that the field of the present invention is concerned with oxy-fuel burners and not with air-fuel burners which are totally separate and distinct.

Having regard to the document US-A-4 241 673 the furnace described therein recirculates air and combustion products which is not necessary in the method of burning fuel according to the invention. The feature of Claim 1 according to the auxiliary request that "substantially complete combustion can be maintained without the necessity of adding external heat or fuel gas to said oxy-fuel burner" clearly distinguishes the invention from the use of lances which are always associated with an external source of heat.

VII. The Respondent requested that the appeal be dismissed. In the oral proceedings before the Board, he submitted the document WO86/05520 in order to provide a definition of the terms "lance" and "burner".

In support of his request, he put forward essentially the following arguments:

(D3) describes a method of operating a system for burning pulverised coal which requires no additional oil or fuel gas.

The newly cited document WO86/05520 relates to a blast furnace into which oxygen and coal are introduced. It is clear from this document that there is no difference between a lance and a burner. It follows from the equivalence of these two terms that the skilled person starting out from the relevant prior art according to (D1) would consider the disclosure of (D2) and thus arrive at the subject-matter of Claim 1 according to the

main request. No hindrance whatsoever to combining these documents can be recognised so that Claim 1 contains no inventive subject-matter.

Claims 1 to 5 according to the auxiliary request are similar to the granted Claims 1 to 5 as to their substance.

Feature (e) of Claim 6 according to the auxiliary request concerning recovering the ash formed by burning a mixture of oxygen and pulverised fuel extends beyond the content of the application as filed, (Article 123(2) EPC).

Furthermore, Claim 6 and Claims 7 to 10 dependent on Claim 6 extend the protection conferred so that these claims infringe Article 123(3) EPC.

Reasons for the Decision

1. The appeal is admissible.

Main request:

2. *Novelty*

- 2.1 The closest prior art is described, undisputed by the parties to the appeal proceedings, by document (D1) which discloses all the features of the pre-characterising portion of Claim 1.

In this known method, a burner being supplied with air, oxygen-enriched air or pure oxygen is provided (see page 2, lines 67 to 69 and page 3, lines 115 to 130).

The skilled person is further informed (see page 2, lines 82 to 90 and page 4, lines 14 to 20 that, depending on the density of the pulverised fuel medium conveyed in a carrier gas it may be possible to discontinue or reduce the rate of supply of the combustible fluid once the desired operating temperature has been reached ..., that is at the desired point of operation.

- 2.2 The method according to Claim 1 differs from the method known from (D1) by the features according to the characterising portion of Claim 1.

Since (D1) reflects the closest prior art, it follows that the subject-matter of Claim 1 is novel in the sense of Article 54 EPC.

3. *Inventive step*

- 3.1 Starting from the prior art disclosed by (D1) as analysed in the description of the patent in suit, the underlying problem is seen in providing a more efficient combustion, in particular avoiding an appreciable quantity of uncombusted carbon in the ashes.

In order to solve this problem, in accordance with the characterising portion of Claim 1, the dense phase material flow transport system delivers between 20 and 30 kg of pulverised material to the oxy-fuel burner per 1 kg of propellant whereby substantially complete combustion takes place without the necessity of adding fuel gas to the burner.

In the introductory portion of the description it is pointed out that in testing the method according to the invention the pulverised fuel and oxygen burnt with an

intense high-temperature flame and that the ash had the appearance of silica sand and negligible residual carbon was found.

These test results have not been disputed by the Respondent and the Board sees also no reason to question them. As a further factor relevant to the efficiency and the degree of combustion, the amount of oxygen and the degree of mixing of the oxygen with the fuel have to be considered.

Claim 1 contains, however, no information concerning these points. Assuming that the supply of the oxygen to the fuel, and their mixing, are effected under technically satisfactory conditions, it is credible to the Board that the problem as outlined in the description is solved by Claim 1.

- 3.2 In the technical field of combustion of fossilised fuels, it is a constant aim to achieve a high efficiency of combustion with a content of combustible compounds in the ashes as low as possible, since otherwise a waste of energy would occur.

The problem of providing a more efficient combustion, in particular avoiding an appreciable quantity of uncombusted carbon in the ashes, cannot, therefore, be regarded as comprising an inventive idea, but originates from the normal economically-based approach of the person skilled in the art.

- 3.3 It is undisputed by the Appellant (see page 2, section 8 of the Statement of Grounds of Appeal) that document (D2) describes a method of operating a system for burning pulverised fuel, namely coal, in which the dense phase material flow transport system delivers between 20 and 40 kg of pulverised material per 1 kg of

propellant to a lance, that is a range within which the method according to Claim 1 is working (see (D2), page 215, left-hand column, paragraphs 3 to 6).

The document WO86/05520 submitted by the Respondent during the oral proceedings relates to a method of iron-making by means of a smelting shaft furnace including the steps of supplying iron ore and coke to the top of the furnace and injecting coal and oxygen into the smelting zone of the furnace to promote combustion:

As indicated in Claim 13, coal and oxygen are injected by means of oxygen and coal burners disposed around the furnace.

Page 3, line 23 ff. of the citation is worded as follows:

"The oxygen and coal may be introduced by means of a single entry element or assembly such as a lance or burner or the coal may be separately entered into the furnace from the oxygen, for example, by separate lances ..."

It is clear from this disclosure that the term "lance" is used in a two-fold way, that is according to the first meaning, it is equivalent with the term "burner" and according to a second meaning it is an element of a burner, the latter meaning being also confirmed by (D2), Figure 14 on page 217, which illustrates a coal-conveying lance as an element of a burner.

Thus, the skilled person conceives a lance either as an equivalent to or an essential part of a burner. The argument of the Appellant in this respect that the

operation of a lance is clearly distinguished from that of a burner does not convince the Board, since it is not supported by the terminology used in the art.

The skilled person will therefore take into consideration the disclosure of (D2) receiving the information that the ratio of mass of pulverised fuel to mass of propellant may be in the range of 20 to 40, that is within the range claimed in order to arrive at a pulverised fuel charge of the propellant favourable to the combustion.

The further feature of Claim 1 that substantially complete combustion takes place without the necessity of adding fuel gas to the burner concerns in one respect a mere repetition of the problem, that is a goal generally strived for in combustion processes. In the other respect, the skilled person is already taught by (D1) that it may be possible, depending upon the ratio of the mass of pulverised fuel to the mass of the propellant gas, to discontinue the supply of additional fuel in fluid form (see above section 2.1). (D2) provides thus a clear pointer to the possibility of operating the system for burning pulverised fuel without adding combustible fluid and the skilled person is induced thereby to check whether on the particular point of operation of the "dense phase" mass flow of pulverised material selected such a mono-fuel combustion can be maintained.

Apart from this disclosure of (D1), in any method of burning pulverised fuel, the skilled person will dispense with adding additional fuel gas to the burner whenever an efficient combustion is possible with the pulverised fuel as the only energy source. The use of more than one type of fuel not only causes a more expensive storage and supply of fuel, but also complicates the control of conveying the fuel to the burner.

- 3.4 The Appellant argues further that oxygen-fuel burners and air burners are totally separate and distinct.

It is clear from the commonly known principles of combustion that a burner which is charged with oxygen instead of air provides a more efficient combustion and a flame of higher temperature whilst the basic construction of the burner whether supplied with air or with oxygen is unchanged. This is confirmed by document (D1) (see page 3, line 115 to page 4, line 30) according to which the same burner may be charged with air, oxygen-enriched air or pure oxygen, depending upon the specific operation phase and conditions. The above-cited argument of the Appellant cannot, therefore, be accepted.

- 3.5 No convincing argument for the existence of an inventive step in the subject-matter of Claim 1 has been presented. Moreover, no obstacle can be recognised which would have prevented the skilled person from incorporating the teaching of document (D2) in respect of the mass flow ratio of the pulverised material to the propellant into the method according to document (D1). It should also be pointed out that both of these citations relate to burners fed by pulverised fuel in a dense phase mass flow and that the aspect of improving the efficiency of combustion has to be considered as being part of the normal considerations of the person skilled in this art in general.

- 3.6 Summing up, the Board comes to the result that the subject-matter of Claim 1 is not based on an inventive step in the meaning of Article 56 EPC, so that this independent claim cannot be maintained and the main request has to be rejected.

Auxiliary request:

4. The independent Claims 1 and 6 comprise the feature that substantially complete combustion can be maintained without the necessity of adding external heat to the oxy-fuel burner.

As admitted by the Appellant, the originally filed documents of the application underlying the patent in suit do not contain any explicit disclosure of this feature. The same consideration applies to the feature of Claim 6 "A method of recovering ash from pulverised fuel" and to the step "(e) recovering the ash formed in step (d)".

With regard to the feature concerning the avoidance of adding external heat to the burner, the Appellant argues that the original disclosure does not mention that external heat has to be added to the burner and that this absence has to be regarded as relevant disclosure.

According to the jurisprudence of the Boards of Appeal (see T 170/87 OJ EPO 1989, 441, section 8.3) the disclosure of a particular feature must be such that the feature can be inferred in an individualised form from the originally filed description, claims or drawings.

In agreement with the above-cited decision, the Board is of the opinion that the mere absence of a feature in the originally filed documents does not make it unequivocally inferable that such a feature is to be excluded and that such exclusion forms part of the invention. Such a feature cannot be regarded as specifically disclosed and may not, therefore, be integrated in a claim.

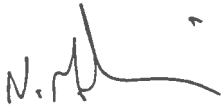
For the above reasons, Claims 1 and 6 infringe the regulation according to Article 123(2) EPC. It follows that the auxiliary request comprising the independent Claims 1 and 6 and Claims 2 to 5 and 7 to 10 dependent thereupon has also to be rejected.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:



N. Maslin

The Chairman:



C. T. Wilson

