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Bezeichnung der Erfindung:
Title of invention:
Titre de l'invention : Thermal reactor of fluidizing bed type

Klassifikation / Classification / Classement : F23G 5/00, F23K 3/16, B01J 8/24, B01J 8/44, B65G 33/06

ENTSCHEIDUNG / DECISION

vom / of / du 19 June 1990

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent / Titulaire du brevet : Ebara Corporation

Einsprechender / Opponent / Opposant : OI Superburn Systems Ltd
OII L&C Steinmüller GmbH

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Art. 56

Schlagwort / Keyword / Mot clé : "Inventive step (yes)"

Leitsatz / Headnote / Sommaire

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Case Number : T 146/89 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 19 June 1990

Appellant : (Proprietor of the patent)
Ebara Corporation
11-1, Haneda Asahi-cho
Ota-ku, Tokyo, 144 (JP)

Representative :
Wagner, Karl H.
Wagner & Geyer Patentanwälte
Gewürzmühlstrasse 5
Postfach 246
D-8000 München 22 (DE)

Respondent I : (Opponent 01)
Superburn Systems Ltd
Faverdale North
Faverdale Industrial Estate
Darlington
County Durham DL3 OPH (GB)

Representative :
Fisher, Adrian John
Carpmaels & Ramford
43 Bloomsbury Square
London WC1A 2RA (GB)

Respondent II : (Opponent 02)
L&C Steinmüller GmbH
Postfach 100855/100865
D-5270 Gummersbach (DE)

Representative :
Carstens, Wilhelm
L&C Steinmüller GmbH
Patentabteilung
Postfach 100855/100865
D-5270 Gummersbach (DE)

Decision under appeal : **Decision of the Opposition Division of the European Patent Office dated** 15 December 1988 and posted on 18 January 1989 **revoking European patent No.** 56 851 **pursuant to Article 102(1) EPC.**

Composition of the Board :

Chairman : F. Gumbel
Members : P. Alting van Geusau
W. Moser

Summary of Facts and Submissions

I. The mention of grant of European patent No. 56 851 in respect of European patent application No. 81 109 623.9 filed on 11 November 1981 and claiming two priorities of 27 January 1981 and 29 January 1981 of earlier applications in Japan was announced in Bulletin 85/41 of 9 October 1985.

The patent specification contains 14 claims with one independent claim which reads as follows:

"1. A thermal reactor (6) of the fluidizing bed type comprising a vertical generally rectangular furnace housing (80);

a diffusion mechanism (8, 42-45) disposed at the lower portion inside of said housing so as to extend from wall to wall of said housing, said diffusion mechanism (8, 42-45) comprising a plurality of gas chambers (43-45) coupled to a pressurized gas source (7) so that fluidizing gas is injected upwardly, through the top portion of the diffusion mechanism (8, 42-45), the mass flow of the gas injected upwardly being arranged so that it is greater at the portions adjacent the walls than at the center portion to produce a moving bed (46) above said center portion and fluidizing bed means (10) adjacent said moving bed (46) and said walls, said fluidizing bed means (10) moving upwardly and whirling adjacent the walls of said furnace housing and said moving bed (46) generally tending to descend between the fluidizing bed means (10);

a material charging device (5) for charging material to be processed onto the top portion of said moving bed (46);

deflecting means (9) extending from said walls towards the center of the housing, and terminating to provide a gap at the portion above said moving bed (46), the

respective lower surfaces of said deflecting means (9) being inclined so as to deflect the upward flow of the fluidizing bed means (10) toward said portion above the moving bed (46); and a discharge means (12) disposed below said diffusion mechanism and communicating with the opposite lateral ends of said top portion of the diffusion mechanism (8, 42-45) through discharge ducts (49) disposed at said opposite lateral ends, respectively, said top portion of the diffusion mechanism being configured so as to aid movement of the fluidizing medium and incombustible items toward said discharge means (12) through said discharge ducts (49), said thermal reactor being characterized in that

the diffusion mechanism (8, 42-45) extends between two opposite side walls of the furnace housing (80) and comprises a top portion configured to be of a gable roof or chevron shape

the space from the top portion of said diffusion mechanism (8, 42-45) up to said deflecting means and between the opposite side walls being clear of any obstructions to flow in the direction between said opposite side walls whereby said moving bed (46) and said fluidizing bed means (10) are directly adjacent each other and can contact each other freely, and

two deflecting means (9) extend from said two opposite side walls towards the center of said housing (80)."

II. Notice of Opposition was filed on 5 July 1986 by

(01) Superburn Systems Ltd

and on 9 July 1986 by

(02) L&C Steinmüller GmbH.

The Respondents I and II (Opponents 01 and 02) requested revocation of the patent on the grounds of Article 100(a) EPC, in particular lack of inventive step of the subject-matter of the patent.

III. By a decision given at the oral proceedings of 15 December 1988 and posted in written form on 18 January 1989 the Opposition Division revoked the patent on the ground of lack of inventive step of the subject-matter of Claim 1 in view of the teachings of JP-A-5 516 416 (D6) and GB-A-1 299 125 (D1).

IV. On 23 February 1989 an appeal was lodged against this decision and the appropriate fee was paid.

The Statement of Grounds of Appeal was received on 29 May 1989.

The Appellant (Proprietor of the patent in suit) requests cancellation of the decision under appeal and maintenance of the patent in granted form.

V. By letter of 12 February 1990 the Board summoned the parties to oral proceedings in accordance with a request for oral proceedings filed by the Appellant on 2 June 1989.

At the oral proceedings held on 19 June 1990 the Appellant and Respondent II were present. Respondent I neither filed any observations nor did he attend the oral proceedings.

VI. The Appellant's arguments in support of the allowability of his request can be summarised as follows:

In the development of thermal reactors of the fluidized bed type the basic idea was to divide the bed into an area

(moving bed) wherein refuse could be dried and made brittle and an area (fluidized bed) wherein the so dried refuse could be incinerated.

GB-A-1 299 125 (D1) shows an early example of such a thermal reactor. In order to provide sufficient flow of the moving and fluidized bed portions (circulation) supply of secondary air was necessary.

The reactors disclosed in GB-A-1 577 717 (D2) or JP-A-55 165 416 (D6) represent further developments in which, in order to improve the flow and bed depth, the moving bed and the fluidized bed were divided by way of partition walls. The partition walls are therefore essential elements in these prior art reactors and the skilled man would therefore not consider their omission.

In the claimed reactor the omission of the partition wall thus goes against the normal progress of technology which must be construed as an indication of inventive step.

Further, the invention provides not only for the omission of the partition walls but also gives rise to an unforeseen, totally new and highly effective flow pattern.

Contrary to the flow pattern in D1, D2 and D6, which is essentially a "streamline" flow, the flow in the claimed reactor is a turbulent flow which brings about improved capacity to draw in the refuse and to classify the refuse by weight due to horizontal flow components which avoids the formation of clinker and thereby improves the combustion efficiency even with the omission of crushers, which are usually necessary in order to comminute the refuse.

During the oral proceedings a video film was shown in which the flow patterns of the various types of reactors was demonstrated on models of such reactors.

The Appellant further referred to the Decision T 69/83 of the Technical Board of Appeal 3.3.1 of 5 April 1984 which, in his view, had apparently been borne in mind by the Opposition Division in their statement on page 6, para. 2 of the decision. It was pointed out that this decision related to a different situation and drawing a parallel with the present case did not take proper account of the fact that nobody (except the inventors) had realised any problems arising from the existence of the partition walls.

VII. In his counterstatements Respondent II essentially argued as follows:

It cannot be said that the arrangement of D2 was developed to overcome the disadvantages of D1 since nothing is explicitly stated in D2 about the arrangement of D1.

Therefore, if the operation of plants comprising partition walls would show certain drawbacks which related to the partition walls the skilled person, knowing from D1 that operation without the walls is possible, would leave the walls out. He would do so also in view of the desire to avoid any components subject to wear.

The specific flow pattern referred to by the Appellant as a "Figure 8" pattern is not disclosed in the patent and it has to be doubted that such a flow can be achieved without further features, not specified in the independent claim.

Further, according to a statement on page 19 of D6 (English translation) also in this known reactor "clinker

is substantially prevented from occurrence and it is able to burn even articles of comparatively larger particle size whereby the crushing for pre-treatment is simple in extent or it may be saved".

Therefore, the alleged effects are not substantial; thermal reactors with partition walls have advantages in burning off particular fuel and disadvantages when burning material that lead to clogging. If such clogging occurs, leaving out the partition wall must be regarded as a simple measure against such clogging and is therefore without any inventive merit.

Respondent II requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. The Board is satisfied that Claim 1 as granted is in agreement with Article 123(2) EPC. This requirement has not been disputed in the proceedings before the EPO and therefore in the Board's opinion does not have to be substantiated in detail.

3. **Novelty**

3.1 As agreed upon by the parties, the nearest prior art is disclosed in JP-A-55 165 416 (D6), in particular considering the embodiment shown in Fig. 3 of this document.

This embodiment discloses a thermal reactor of the fluidizing bed type comprising a vertical, generally rectangular furnace housing (1) (page 15, lines 5 to 7 of

the English translation);
a diffusion mechanism (21,22) disposed at the lower portion inside of said housing so as to extend from wall to wall of said housing, said diffusion mechanism (21,22) comprising a plurality of gas chambers (22a,b,c) coupled to a pressurised gas source (31) so that fluidizing gas is injected upwardly, through the top portion of the diffusion mechanism (21,22), the mass flow of the gas injected upwardly being arranged so that it is greater at the portions adjacent the walls than at the centre portion (page 12, lines 6 to 20) to produce a moving bed (B) above said centre portion and fluidizing bed means (A,C) adjacent said moving bed (B) and said walls, said fluidizing bed means (A,C) moving upwardly and whirling adjacent the walls of said furnace housing and said moving bed (B) generally tending to descend between the fluidizing bed means (A,C);
a material charging device (29) for charging material to be processed onto the top portion of said moving bed (B);
deflecting means (24) extending from said walls towards the center of the housing, and terminating to provide a gap at the portion above said moving bed (B), the respective lower surfaces of said deflecting means (24) being inclined so as to deflect the upward flow of the fluidizing bed means (A,C) toward said portion above the moving bed (B); and a discharge means disposed below said diffusion mechanism and communicating with the opposite lateral ends of said top portion of the diffusion mechanism (21,22) through discharge ducts (34) disposed at said opposite lateral ends, respectively, said top portion of the diffusion mechanism being configured so as to aid movement of the fluidizing medium and incombustible items toward said discharge means through said discharge ducts (34), whereby

(a) the diffusion mechanism (21,22) extends between two opposite side walls of the furnace housing (1) and comprises a top portion configured to be of a gable roof or chevron shape, and

(b) the two deflecting means (24) extend from said two opposite side walls towards the centre of said housing (1).

3.2 It is noted that the features (a) and (b) above are comprised in the characterising part of Claim 1 of the patent in suit.

Considering that D6 and also D2 (GB-A-1 577 717) referred to in the patent in suit comprise in addition to the pre-characterising features the above features (a) and (b), Claim 1 is not satisfactorily related to the nearest prior art as required by Rule 29(1) EPC.

However this requirement is not a ground of opposition (Article 100 EPC) and is to be disregarded when the patent is upheld as granted (see Order; and Article 102(2) EPC in connection with Rule 66(1) EPC).

3.3 The thermal reactor according to Claim 1 of the patent in suit differs from the known thermal reactor disclosed in D6 (or D2) in that the space from the top portion of said diffusion mechanism (8, 42-45) up to said deflectory means and between the opposite side walls is free of any obstruction to flow in the direction between said opposite side walls whereby said moving bed (46) and said fluidizing bed means (10) are directly adjacent each other and can contact each other freely.

3.4 The remaining cited documents do not come as close to the claimed subject-matter as the above discussed documents D6

and D2; therefore the thermal reactor according to Claim 1 is considered to be novel within the meaning of Article 54 EPC.

4. Inventive step

4.1 As is indicated in column 2, starting from line 44 of the patent in suit, the use of the known thermal reactor disclosed in D2, which is essentially similar in construction to the reactor disclosed in D6, gives rise to a variety of problems such as clogging of the gap between the lower end of the partition wall and the diffusion plate, a limited circulation rate of the bed, a limited range of control of the moving bed and fluidized bed portions as well as a difficult repair and inspection.

The thermal reactor according to Claim 1 of the patent in suit is, for reasons explained in the following, free from the above drawbacks. Therefore, the underlying problem to be solved by the patent in suit relates to the provision of a thermal reactor which avoids the aforementioned disadvantages of the prior art.

4.2 In the present case, the recognition of the above-mentioned problems cannot, in the Board's opinion, be regarded as forming part of an inventive activity since these prior art drawbacks are easily recognised by the skilled person during normal use of the thermal reactor.

4.3 It has therefore to be considered whether the skilled person would have needed inventive activity to provide the features indicated hereinabove in paragraph 3.2 which, reformulated in their simplest form amount to "taking away the partition walls" in the thermal reactor disclosed in D6 in order to solve the above stated problem.

4.4 As was explained by the Appellant, such a relatively simple solution easily runs the risk of being judged as obvious. However for the evaluation of inventive step only the circumstances of the particular case should be considered in the light of the relevant prior art and further knowledge of the skilled man. In the present case this requires full understanding of the development of the type of thermal reactor concerned which has, according to the Appellant, taken the following line.

Many types of fluidized bed reactors are known in which the fluidized bed may be operated in different ways. An important feature of the fluidized bed in the thermal reactor of the present patent is the provision of downward moving and upward moving bed portions, the latter being fluidized to a higher degree. An early example of such a fluidization with two bed portions is disclosed in D1. This known reactor however lacks the ability of a sufficient circulation of the bed and cannot satisfactorily draw lighter waste parts into the moving bed, which therefore tend to be burnt above the bed, thereby leading to overheating of the upper portion of the bed and insufficient distribution of the caloric input into the bed as well as other disadvantages referred to in a further development of this type of reactor in D2.

In order to improve circulation of the bed, the downward moving and upward moving bed portions are separated by means of partition walls so that the circulation of the portions is guided. In the reactor according to D2 higher rates of circulation could be achieved which improved the reactor efficiency and thus also its capacity, and additionally provided greater flexibility and ease of control (see page 4, line 113 to page 5, line 10 of D2).

The provision of separation walls was therefore a substantial step towards better functioning of this type of fluidized bed reactor.

The reactor disclosed in D6, Fig. 3 is substantially identical with the reactor disclosed in D2 and therefore the same technical reasons apply to this reactor.

4.5 The Board supports this line of argument. Although D2 does not contain a direct reference to the reactor of D1, as was pointed out by Respondent II, it is in the Board's opinion clear from the discussion of prior art reactors in D2 that such a type of reactor is referred to (see page 1, lines 33 to 50 of D1). A further indication of such a development is that also in D6 the prior art (in particular shown in Fig. 2) comprises reactors without partition walls and the patent publication D6 itself claims an improvement over these reactors by the use of partition walls.

4.6 Considering the drawbacks of the prior art to be avoided by the reactor according to Claim 1 of the patent, only some of these drawbacks are recognisably directly related to the presence of partition walls e.g. the difficult repair and inspection and to some extent clogging. However, as was put forward by the Appellant, clogging of the opening between the diffusion plate and underside of the partition wall is essentially due to "clinker forming" which is caused by partially overheated regions in the bed where material may melt and fuse into solid non-combustible products (see also D2, page 1, lines 16 to 25) and which are an indication of insufficient circulation in the bed.

The drawbacks which relate to such clinker forming, i.e. limited circulation rate and limited range of control of

the bed portions, cannot, in the Board's opinion, be regarded as being directly attributed by the skilled person to the partition walls for the reason that the walls are said in D2 to improve the circulation and control (see page 4, line 113 to page 5, line 10). Further, no indication can be derived from D1 or D6 that in the prior art reactors disclosed therein without partition walls clinkering has not occurred.

Therefore, seen in the light of the above discussed prior art the skilled man could not find a teaching in the available disclosures to omit the partition walls in order to avoid the main drawbacks of the prior art reactors.

The drawbacks relating to difficult repair and inspection are considered of secondary importance and cannot, in the Board's opinion, be construed as a valid reason for omission of the walls, considering the teaching in D2 and D6 according to which the walls provide advantages with respect to circulation control and combustion efficiency which are essential features of the type of reactor concerned.

4.7 It cannot be said either that taking out the partition walls in D6 the reactor according to Fig. 3 of D6 was the only solution to the above stated problems even when focusing on the clogging aspect of these problems.

Further measures and modifications could also have been related to experiments with the walls themselves, such as shorter length of the walls in order to provide a bigger gap or positioning of the walls at an angle. Other means including further circulation promoting air sources, (secondary air) could also have been taken into consideration.

4.8 The Board noted that in the opposition procedure the Appellant referred to a "Fig. 8" flow pattern in the bed which was considered to be a surprising new effect.

In the explanations given particularly during the oral proceedings before the Board reference was made to a turbulent flow with horizontal components rather than a "Fig. 8" flow. The first type of flow was convincingly demonstrated by showing the flow pattern in a model of the claimed reactor in a video film and the Board has, in view of the comments given by an expert on behalf of the Appellant, no reason to doubt that the demonstrated flow is indeed achieved in the claimed axisymmetric reactor.

The Respondent II also refrained from expressing any doubt with respect to this demonstrated flow pattern.

4.9 It was further, in the Board's opinion, convincingly expounded during the oral proceedings that the flow in the beds of models of reactors according to D1 and D6 is essentially a stream flow with low turbulence.

The flow in the claimed reactor model, on the other hand, showed great turbulence with horizontal flow components which spread out the refuse from the dropping point over the entire bed. This advantageous effect could, in the Board's view, not be expected when considering the flow patterns of D1 and D6.

Although it is true that in D6 reference is made to the avoidance of clinker forming and the omission of a feeding shredder for the refuse, the Board agrees with the Appellant that such a statement does not necessarily mean that this effect is achieved under all circumstances or cannot be further improved. In view of the demonstrated flow pattern in the reactor of Claim 1 and the

explanations given by the expert of the Appellant during oral proceedings, the Board is convinced that the turbulent flow pattern with its horizontal flow components creates better conditions for the avoidance of clinker forming when compared with the streamline flow in the arrangements disclosed in D1, D2 and D6. This turbulent flow pattern obviously further gives a unprecedented advantage in the incineration of larger refuse parts so that it is highly probable that unshredded material can be burnt in the claimed reactor.

4.10 The question whether or not the Opposition Division has incorrectly used the decision T 69/83 in the present case as alleged by the Appellant does not, in the Board's opinion, have to be considered in detail. It be only remarked that, as shown above, the skilled person was in fact not faced with directly recognisable problems, clearly related to the partition walls, which is the starting point of the Opposition Division's argumentation.

4.11 Summarising, the Board comes to the conclusion that the subject-matter of Claim 1 was not the consequence of normal progress of the relevant technology in this field, together with the exercise of normal skills of a practitioner, but indeed involves an inventive step. Claim 1 as granted must therefore be maintained.

5. The patentability of the dependent Claims 2 to 14 is supported by the patentability of the independent Claim 1, since these claims comprise further embodiments of the reactor specified in Claim 1.

6. The Board noted that the embodiments disclosed in Fig. 19 to 21 of the patent in suit do not apparently follow the definition of the reactor of Claim 1 with respect to their

diffusion mechanism. However this defect does not constitute a ground of opposition and therefore the patent in suit cannot be amended in this respect at the present stage of the procedure (cf. Art. 102 and 103 EPC).

Order

For these reasons, it is decided that:

1. The impugned decision is set aside.

2. The European patent No. 0 056 851 is maintained as granted.

The Registrar: The Chairman:

S. Fabiani F. Gumbel

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