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# D E C I S I O N
# of 13 May 2004

**Case Number:** T 0352/02 - 3.2.3

**Application Number:** 96107112.3

**Publication Number:** 0730910

**IPC:** B04C 5/081, B04C 5/28
B01J 8/38

**Language of the proceedings:** EN

**Title of invention:**
Circulating fluidized bed reactor

**Patentee:**
Foster Wheeler Energia Oy

**Opponent:**
Alstom Power Boilers

**Headword:**
-

**Relevant legal provisions:**
EPC Art. 56

**Keyword:**
"Inventive step - non-obvious combination of known features"

**Decisions cited:**
-

**Catchword:**
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

**Case Number:** T 0352/02 - 3.2.3

# D E C I S I O N
## of the Technical Board of Appeal 3.2.3
## of 13 May 2004

| | |
|---|---|
| **Appellant:** (Opponent) | Alstom Power Boilers<br>19/21 Avenue Morane Saulnier<br>F-78140 Vélizy Villacoublay (FR) |
| **Representative:** | Intès, Didier Gérard André<br>Cabinet Beau de Loménie<br>158, rue de l'Université<br>F-75340 Paris Cedex 07 (FR) |
| **Respondent:** (Proprietor of the patent) | Foster Wheeler Energia Oy<br>SF-00440 Helsinki (FI) |
| **Representative:** | Füchsle, Klaus, Dipl.-Ing.<br>Hoffman Eitle,<br>Patent- und Rechtsanwälte<br>Arabellastrasse 4<br>D-81925 München (DE) |
| **Decision under appeal:** | **Decision of the Opposition Division of the European Patent Office posted 11 February 2002 rejecting the opposition filed against European patent No. 0730910 pursuant to Article 102(2) EPC.** |

**Composition of the Board:**

**Chairman:** C. T. Wilson
**Members:** F. Brösamle
J. P. B. Seitz

## Summary of Facts and Submissions

I. With decision of 11 February 2002 the opposition division rejected the opposition against European patent No. 0 730 910 pursuant to Article 102(2) EPC.

II. Granted claim 1 underlying the above decision reads as follows:

"1. A circulating fluidized bed reactor, comprising:

- a reactor chamber (10), restricted horizontally mainly by vertical planar or curved walls or by cylindrical walls;
- means (24, 26) for introducing fluidizing gas into the reactor chamber, for maintaining a fluidized bed in the chamber,
- a centrifugal separator (12), connected to the reactor chamber, for separating solid particles from gases discharged from the reactor chamber,
- a return duct (14), for returning the solids separated in the separator (12) into the fluidized bed in the reactor chamber (10), the centrifugal separator (12) comprising

  - a vertical vortex chamber, which has walls (32, 34, 36, 38) defining an interior gas space (31), and an upper section (43) and a lower section (45),
  - at least one inlet (30), for gases to be purified, disposed in the upper section of the vortex chamber,

– at least one outlet (54, 56) for the purified gases, from the vortex chamber,
– at least one outlet (46) for the separated particles, disposed in the lower section of the vortex chamber and connected to the lower portion of the reactor chamber,

said inlet, outlets and vortex chamber defining at least one vertical gas vortex in the vortex chamber gas space (31),

characterized in that

– said walls (32, 34, 36, 38) of the vortex chamber are distinctly non-circular,
– the cross section of the interior gas space (31) defined by the walls (32, 34, 36, 38) of the vortex chamber is in the shape of a polygon, such as a square or rectangle, and
– at least two opposite walls (32, 36) of the vortex chamber are formed by cooling surfaces."

(The three characterising features of the claim are hereinafter referred to as features "10", "11" and "12" respectively).

III. Against the above decision of the opposition division the opponent - appellant in the following - lodged an appeal on 4 April 2002 paying the fee on the same day and filing the statement of grounds of appeal on 11 June 2002 in which he essentially dealt with

(D2) US-A-4 665 864

(D8) EP-A1-0 205 718

(D9) US-A-4 285 142 and

(HE1) US-A-4 615 715.

IV. Following the board's communication pursuant to Article 11(1) RPBA in which the board expressed its provisional opinion of the case with respect to clarity, novelty and inventive step oral proceedings were held on 13 May 2004 in which the appellant and the patentee - respondent in the following - essentially argued as follows:

(a) Appellant:

– nearest prior art is (D2) disclosing features "10" and "12" of the analysis of features according to the statement of grounds of appeal since the side walls (features "10" and "12") only enclose the vortex chamber and not to define the inner space thereof;

– the problem to be solved by the invention, namely to create an effective and cheap vortex chamber is non-technical and trivial;

– starting from (D2) a skilled person turned to documents which deal with interior gas spaces such as (HE1), (D8) and (D9) dealing with devices in which solids are separated from gases *inter alia* by making use of non-circular vortex chambers;

– combinations of the above documents deprive the subject-matter of claim 1 from inventive step since it is irrelevant in this respect that the vortex chamber of (D9) is horizontal and that (D8) relates to a steam generator being, however, very close to fluidized bed reactors;

– with respect to (HE1) it is observed that there exists a cooled surface in form of a water wall and a single inner wall - the space in between being filled with a refractory material;

– only in granted claim 18 it is set out that the gas space of the vortex chamber is covered by refractory material being such an essential feature of the invention that it should have been incorporated into claim 1.

(b) Respondent:

– the subject-matter of claim 1 is based on a circulating fluidized bed reactor (CFB) being characterised by a big throughput of material of hot and coarse particles which have to be recirculated to the fluid bed, by way of a short loop;

– features "10" and "12" of claim 1 relate to the vortex chamber, however, clearly in combination with the CFB reactor and its construction as defined in the preamble of claim 1;

– the subject-matter of claim 1 being novel the crucial issue to be decided is inventive step of the **combination** of features of granted claim 1;

– none of the features "10" to "12" of claim 1 being known from (D2) the further prior art is irrelevant for a skilled person for achieving the claimed subject-matter since (HE1) discloses a cooled outer wall, however, in combination with a circular vortex chamber, (D9) is focussed on a horizontal vortex chamber and is not linked to a CFB reactor, and (D8) is based on a steam generator and not on a CFB reactor in which material has to be recirculated from the separator to the CFB reactor and since (D9) teaches against the use of a vertical vortex chamber;

– since no incentive could be seen to combine (HE1), (D2), (D8) and (D9) the subject-matter of claim 1 is novel and inventive.

V. The appellant requested that the decision under appeal be set aside and that the European patent No. 0 730 910 be revoked.

VI. The respondent requested that the appeal be dismissed.

## Reasons for the Decision

1. The appeal is admissible.

2. *Novelty*

Before the board the appellant did not in fact question novelty of the subject-matter of claim 1 in the light of (HE1), (D2), (D8) and (D9) and since the board is also of the opinion that none of the above documents discloses all features of claim 1 - see its communication pursuant to Article 11(1) RPBA, remark 5 - no detailed discussion of novelty is necessary and the crucial issue to be decided is inventive step.

3. *Inventive step*

3.1 Claim 1 is delimited over (D2); in its precharacterising clause all known features are set out, defining basically a reactor chamber, means for introducing fluidizing gas into the chamber, a centrifugal separator for separating solid particles from gases, a return duct for returning solids to the centrifugal separator; thereafter the centrifugal separator is defined as a **vertical** vortex chamber having at least one inlet and at least one outlet for the purified gases and for the separated particles, these features defining at least one vertical gas vortex in the vortex chamber gas space.

From (D2) for a skilled person not knowing the claimed invention nothing is derivable with respect to the **cross section** of the **gas space** of the vortex chamber since (D2) is restricted to longitudal sections through the circulating fluid bed reactor only, see its Figures 1 to 6.

3.2 Starting from (D2) the objectively remaining technical problem to be solved is seen to be to provide a fluidized bed reactor which is simple in construction,

less expensive to manufacture and less susceptible to damage taking into account the high material throughput of hot and eroding material.

With respect to assessment of inventive step it has **not** to be decided whether or not the above problem to be solved is in itself inventive but rather it has to be decided whether or not its solution as laid down in claim 1 is inventive. It is therefore irrelevant whether the above problem is partly of a general nature or as argued by the appellant is not technical but rather covers a commercial aspect, namely a less expensive manufacture, an argument which is not accepted by the board since a less expensive manufacture is closely related to technical features and advantages - as will be shown below.

3.3 The above problem is solved **by the features of claim 1** i.e. its three characterising features - features "10" to "12" according to appellant's analysis - in combination with the precharacterising features of claim 1 linking the distinctly non-circular vortex chamber, the cross section of its interior gas space in the shape of a polygon and at least two opposite walls of the vortex chamber formed by cooling surfaces to a **fluidized bed reactor** and its **vertical** vortex chamber.

It is immediately clear that granted claim 1 **is open** with respect to a lining of refractory material or not so that claim 1 has to be interpreted as it is when assessing the issue of inventive step of its subject-matter.

3.4 As a general remark the board is convinced that the crucial issue of a vortex chamber is its inner wall/gas space. As mentioned above and as set out in the board's communication pursuant to Article 11(1) RPBA, see paragraph 5.2 in particular, (D2) is completely silent about the cross section of its cyclone separator so that appellant's arguments are nothing but assumptions knowing the claimed invention.

3.5 In the board's above communication, see its paragraph 6.4, the board dealt with the correct reading/understanding of claim 1 resulting in the findings that **the combination of features of claim 1** has to be considered when assessing the inventive merit of the subject-matter claimed.

It is obvious that there exists a technical interrelationship between the characterising and pre-characterising features of claim 1, namely the high throughput of hot and eroding material and the features relating the shape of the gas space of the vortex chamber and its structure comprising at least two opposite cooling surfaces.

3.6 With the subject-matter of claim 1 a simple construction is achieved since the walls defining the gas space of the vortex chamber are planar and therefore easy to manufacture, and result in a reliable and efficient centrifugal separator taking into account the necessary measures (cooled surfaces) to cope with the high throughput of hot and eroding material of a circulating fluidized bed reactor.

3.7 Similarly to (D2), (HE1) clearly discloses a non-circular **outer** form of the cyclone separator not, however, the claimed **non-circular gas space** so that a skilled person is not taught how the above problem of the claimed invention could be solved.

3.8 (D8) and (D9) do not deal with the claimed fluidized bed reactor so that they relate to a different technical field not necessarily having the same technical background as the invention, namely high throughput of hot and eroding material through the cyclone separator.

It has moreover to be observed that (D8), see its Figures 3 and 4, simultaneously teaches the provision of a circular gas space (Figure 3) and of a non-circular gas space without leading a skilled person **clearly** and **unambiguously** to a non-circular gas space as claimed. Favouring the alternative disclosed in Figure 4 of (D8) is therefore nothing else than an interpretation knowing the claimed invention.

3.9 (D9) clearly discloses a non-circular gas space of a cyclone separator, however, not in combination with a circulating fluidized bed reactor and its specific problems, namely *inter alia* the **hot** material necessitating at least two opposite cooled surfaces of the gas space. The problem of (D9) has nothing to do with the above problem of the invention, since (D9) aims at reducing the **overall height** of its suspension type heat exchanger leading to a **horizontal** orientation of its cyclone separator in direct contrast to the claimed **vertical** vortex chamber/gas space, see preamble of claim 1.

3.10 Under these circumstances a skilled person confronted with the objectively remaining technical problem, not knowing the claimed solution thereof according to claim 1 was not lead in a direct way by (D2), (HE1), (D8) and (D9) to the subject-matter of claim 1 which is therefore not only novel but also is inventive. Claim 1 as granted is therefore **valid**.

3.11 Granted dependent claims 2 to 34 relate to preferred embodiments and are also valid.

4. In the oral proceedings the board maintained its provisional opinion expressed in the communication pursuant to Article 11(1) RPBA that claim 1 is not open to the objection that it is incorrectly delimited over (D2) as argued by the appellant since the **outer form** of a cyclone separator does not allow any conclusion as to its internal **gas space** and since granted claim 1 has to be read as defining the **gas space** of the vortex chamber and not its outer form.

Appellant's further arguments in respect of the issue as to what a skilled person would derive from the documents to be considered do not take into account that not knowing the claimed invention there could not be seen **an incentive** to consider (D2), (HE1), (D8) and (D9) **in combination**.

5. As a general remark it is added that the description of EP-B1-0 730 910, see for instance column 4, line 46 ("curved"), being contradictory to granted claim 1 and column 13, paragraph [0055], reading "The invention also comprises a **method** of…" - stress added - is in

contrast to claims 1 to 34 as granted since these claims do not relate to a method.

However, such inconsistencies are a matter of Article 84 EPC (claims supported by the description) rather than the grounds for opposition to a consideration of which the board is restricted when the granted patent is the subject-matter of appeal.

## Order

## For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Counillon C. T. Wilson