BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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File No.: T 0564/91 - 3.3.2

Application No.: 87 830 349.4

Publication No.: 0 263 796

Classification: C02F 3/28

Title of invention: Process and device for producing a biological gas from the anaerobical digestion of an organic substance

D E C I S I O N
of 10 November 1993

Applicant: Ente per le nuove tecnologie, l'energia e l'ambiente (ENEA)

Proprietor of the patent: -

Opponent: -

Headword: Anaerobic digestion/ENEA

EPC: Art. 123(2), 54, 56, 111(1)

Keyword: "Added subject-matter; after amendment (no)" - "Exercise of power of substantive examination by the Board" - "Novelty (yes)" - "Inventive step (no); normal design procedures"

Headnote
Catchwords

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0564/91 - 3.3.2

D E C I S I O N
of the Technical Board of Appeal 3.3.2
of 10 November 1993

Appellant: Ente per le nuove tecnologie, l'energia e l'ambiente (ENEA)
Viale Regina Margherita 125
I-00198 Roma (IT)

Representative: Sarpi, Maurizio
Studio Ferrario
Via Collina, 36
I-00187 Roma (IT)

Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 26 February 1991 refusing European patent application No. 87 830 349.4 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P.A.M. Lançon
Members: L. Galligani
E.M.C. Holtz

Summary of Facts and Submissions

I. European patent application No. 87 830 349.4 published under No. 0 263 796 was refused by the Examining Division on 26 February 1991.

The decision was taken on the basis of Claims 1 to 10 filed by letter dated 22 November 1989.

II. The Examining Division refused the application under Article 97(1) EPC on the grounds that the subject-matter of Claims 1 and 2 extended beyond the content of the application as filed and, therefore, contravened Article 123(2) EPC.

The scope of Claim 1 and 2 had been limited during examination proceedings by the introduction of the feature "arranged at the bottom thereof" and "arranged at the bottom of the reactor", respectively, with respect to the heating element(s) provided in the first area of a reactor for the production of biogas. Although admitting that, according to the original drawings, the heating system was arranged near to the bottom of the reactor, the Examining Division - with reference to the Oxford English Dictionary - considered that the preposition "at" meant not only "near to", but also "touching". Thus, in the Examining Division's view, Claims 1 and 2 included also the specific embodiment in which the heating element was in contact with the bottom of the reactor. Since this embodiment was not clearly and unambiguously disclosed in the application as originally filed, the Examining Division decided that Article 123(2) was contravened.

In its decision of refusal the Examining Division added also some comments on the formulation of Claim 10 (the reference to the description was objected to) as well as a general comment on the inventiveness of the subject-matter claimed (denied).

III. The Appellant lodged an appeal against this decision and paid the appeal fee.

The Appellant essentially argued that it was clearly derivable from the original drawings, especially from Figures 1, 4 and 6, that the heating elements were arranged in the lower part of the first chamber of the reactor. Since the function of the said elements was to provide convective motions of the biomass, it was insignificant whether or not they were in contact with or near the bottom of the reactor. Important was that they were not arranged in the upper part of the reactor.

At any rate, the Appellant offered to amend the contested wording in the claims to read "arranged near the bottom". Furthermore, he agreed to the deletion of Claim 10.

IV. In an official communication pursuant Article 110(2) EPC, the Board suggested amendments in the wording of Claims 1 and 2 which could overcome the objection on which the decision under appeal was based.

Furthermore, the Board pointed out that a plant according to Figures 6 and 7 did not fall under the scope of such amended claims because the heating element therein extended also into the upper zone of the first chamber. Consequently, the Board suggested the deletion of the said figures and of the corresponding passages in the description.

In the same communication the Board made also some general observations on substantive matters, in particular with reference to the prior art documents EP-A-0 145 792 (1) and EP-A-0 158 213 (2).

V. In reply to the said communication by the Board, the Appellant filed by letter dated 28 May 1993 amended Claims 1 to 9, an amended description with pages 1 to 8 and figures 1 to 5. The amendments to the specification were in line with the suggestions made by the Board. In particular, in Claims 1 and 2 of the amended set the expressions "arranged in the lower zone thereof" and "arranged in the lower zone of the reactor" replaced the contested expressions "arranged at the bottom thereof" and "arranged at the bottom of the reactor", respectively. Furthermore, in the same claims the term "biomass" replaced the term "organic substance".

In his reply the Appellant also presented arguments in support the patentability of the claimed subject-matter, in particular with respect to document (2).

Claim 1 of the amended set read as follows:

" A double phase process for producing a biogas where the two phases, hydrolysis-acidogenesis and methanegenesis of the biomass to be treated, respectively, evolve in succession and without any stirring in the two areas of a single reactor, characterized in that the biomass is fed in the first area in which the temperature of the mass is maintained greater than 37°C in order to carry out the hydrolysis and acidogenesis processes and then is passed into the second area where the temperature is lower than 37°C in order to obtain the methanegenesis phase, such temperature difference being obtained by ensuring in the two areas an adequate thermal gradient by means of

controlled heating elements arranged in the lower zone thereof and by utilizing a separator element open on the top, tending to promote convective motions of the biomass and to create a preferential path of the same biomass in the upper portion between the two areas."

Claim 2 was directed to the corresponding plant for the production of biogas by means of the said process. Claims 3 to 9 related to specific embodiments of the said plant.

VI. In a further communication pursuant Article 110(2) EPC, the Board - in exercise of its power under Article 111(1) EPC - expressed in detail its doubts that the subject-matter of any of the claims could be seen as involving an inventive step having regard to document (2), in the light also of document (1) and of EP-A-0 120 772 (3).

VII. In his letter of reply the Appellant further argued in favour of inventive step of the claimed subject-matter.

The arguments put forward by the Appellant in his replies are essentially as follows:

(a) the process and plant according to the present application are to be seen as an alternative to the known process and plant according to (2). In the present case a sharp, controlled separation of the two phases, i.e. the hydrolysis-acidogenesis and the methanogenesis, is expressly required. This separation allows a better control of the operation conditions and an increased yield. Any stirring is explicitly excluded. The hydrolysis-acidogenesis phase takes place in the first zone. The methanogenesis phase takes place in the second zone. The operating temperatures in the two zones

are different. The convective motions created by the thermal gradient are not used for mixing or homogenization, but for providing a radial and/or longitudinal movement of the biomass from the first zone to the other.

The process according to the present invention allows flexible solutions of installation, for example the design of reactors with circular plan, U-plan and rectangular plan;

(b) in the process and the plant according to (2) the fermentation control is exerted essentially through a thermal exchange between the fresh biomass and the fermented biomass. The vertical-axial and horizontal-radial movement of the biomass is not functional to the chemical reaction, but to the thermal exchange and to the feeding-restoring of the biomass. The arrangement cannot be flexible because a radially symmetric reactor is required in order to allow the whole reaction to take place in one zone and the thermal exchange in another zone. No distinctive function is attributed in (2) to the different areas of the bioreactor. A uniform circulation of the biomass is provided with the result that either one phase is incomplete or an overlapping of the two phases takes place. The fact that a stirring device is provided in an embodiment (Claim 11) proves that the two phases of the process are no meant to be kept separated.

VIII. The Appellant requests the grant of a patent on the basis of the amended application documents.

Reasons for the Decision

1. The appeal is admissible.

2. *Formal allowability of the amended claims (Article 123(2) EPC).*

There are no objections under Article 123(2) EPC in respect of the amended application documents.

The deletion of Claim 10 as well as the deletion of Figures 6 and 7 and of the corresponding passages in the description do not result in a change of the application beyond its original contents.

As for the wording of Claims 1 and 2, the expressions "arranged in the lower zone thereof" and "arranged in the lower zone of the reactor", respectively, find direct, unambiguous support in the application as originally filed (see Figures 1, 4 and 5 as well as page 6, lines 10 to 19).

The substitution of the term "organic substance" with the term "biomass" finds support *inter alia* on page 4, line 15 of the original application document.

Therefore, an objection under Article 123(2) EPC which was the basis of the refusal of the application no longer applies.

3. *Substantive matters*

The Board noted that during the examination proceedings, the Examining Division had also brought up the question of the patentability of the claimed subject-matter *vis-à-vis* the prior art documents (1) and (2). However, this

had not been pursued in the decision refusing the application which was exclusively based on Article 123(2) EPC.

The Board was of the opinion that in the circumstances of this case it was proper to exercise its power under Article 111(1) EPC and look into the question of patentability of its own motion.

3.1 Novelty (Article 54 EPC)

None of the available prior art documents discloses a process and a plant for producing biogas comprising all the features quoted in the present Claims 1 and 2, respectively. Thus, in the Board's view, the subject-matter of the present claims is novel.

3.2 Inventive step (Article 56 EPC)

(a) The closest prior art

In the Board's view, document (2) constitutes the closest prior art document. This document discloses a reactor for the production of biogas in which each unit is divided by a separator element open on the top into two successive areas communicating with one another. The first of these two areas, wherein the biomass is fed, is provided with heating elements in the lower zone (see drawings in connection with pages 5-7 and page 14, lines 12-23). The second area, wherefrom the fermented biomass is collected, exchanges heat with the incoming biomass and is, therefore, at a lower temperature with respect to the first area. No specific operational temperatures are indicated. The difference in temperature between the two areas of the reactor is stated to favour the convective

motions of the biomass, to support its slow rise in the reactor and to create a preferential path between the two areas (see page 5, line 21 to page 6 line 28). Different construction variants of the reactor are described in (2) (see Figures).

(b) Differences between the closest prior art and the present application

The process and plant according to the present application differ from the process and plant according to (2) essentially in that:

(i) the two phases of biogas production, namely hydrolysis-acidogenesis and methanogenesis, take place in succession in two separate areas of the reactor;

(ii) the temperature of the first and second area is specified to be "greater than 37°C" and "lower than 37°C", respectively.

(c) The underlying technical problem

The technical problem underlying the present application must be assessed in the light of document (2).

The said problem cannot be seen in the **improvement** of the known biogas production process and plant as no specific evidence has been put forward in support of any advantage in comparison with the said closest prior art which could be of relevance for the definition in that sense of the problem underlying the invention (see decision T 20/81 OJ EPO 1982, 217). In particular, no evidence has been

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submitted in support of the alleged increased process yield (see Section VII, item (a)).

Thus, in agreement with the Appellant, the problem is to be seen merely in the provision of an **alternative** process and plant for the production of biogas.

(d) The solution proposed

As an alternative to the known process and plant according to document (2), the Appellant proposes in Claims 1 and 2, respectively, a process and a plant wherein the two phases of anaerobic digestion of the biomass are carried out in two separate areas of the bioreactor at different temperatures (see above Section 3.2, item (b)) without any stirring so that the convective motions produced by the thermal gradient create a preferential path in the upper portion between the two areas.

(e) Assessment of inventive step

(i) The teaching of document (2)

The content of document (2) is that outlined in Section 3.2 (a) above. For the skilled addressee it is clear that in the process and plant according to (2), even if not explicitly stated, the two phases of digestion (hydrolysis-acidogenesis and methanogenesis) evolve in succession within the reactor as the biomass moves from the lower part of the first area to its upper part (axial-vertical movement) and flows over the separator element into the second area (horizontal-radial movement). Inevitably a certain overlapping of the two phases

occurs. However, in view of the geometry of the reactor and of the development of the reactions, the skilled addressee would infer that methanogenesis takes place predominantly in the upper part of the first area and across the separator element in the second area. A temperature gradient is intentionally created between the two areas of the reactor in order to favour the convective motions of the biomass and its rise (not only its mixing) in the reactor. Although stirring is given as an option (see Claim 11), document (2) explicitly states that stirring is not necessary (see page 4, last paragraph). Thus, it seems evident that the technical effect disclosed in document (2) is linked to the temperature gradient in the axial-vertical and horizontal-radial direction.

(ii) The general knowledge

It is part of the general knowledge (see, for example document (3), page 1, lines 20-33 and the introductory part of the present application) that the biochemical reactions involved in the anaerobic digestion of biomass can be divided into at least two phases: a first phase in which the organic material is broken down to produce a variety of organic acids (hydrolysis-acidogenesis) and a second phase in which these simple compounds are converted to methane (methanogenesis). As admitted also in the introductory part of the present application, the skilled person knows that in such reactions operating temperatures from about 26°C to about 40°C can be used (see, for example, document (1), page 8, lines 16-26). The skilled person knows that the temperature plays a particularly important role in determining digestion rates and that the

use of higher temperature in the first phase can be advantageous. This is evident, for example, from document (1) where it is stated that, if faster degradation of the organic materials is required, "the temperature can be increased up to 40°C in the first zone only" (see page 3, lines 3-8).

(iii) The step to the solution proposed in the present case

In the Board's opinion, when attempting to conceive an alternative to the process and plant for the production of biogas according to (2), the skilled person, in the light of his/her general technical knowledge, would in a straightforward manner consider the separation of the two phases of biomass digestion and the definition of the specific operating temperatures therefor. When defining the latter, he/she would obviously select a higher temperature range (up to 40°C) for the first phase and a lower temperature range for the second phase in order to maintain the favourable temperature gradient according to (2) and to achieve a faster degradation of the biomass (see document (1)). Thereby he/she would easily arrive at a process and plant according to the present Claims 1 and 2, respectively. In the Board's view, this is a matter of normal design procedures for which no inventive talent is needed.

Thus, the subject matter of Claims 1 and 2 lacks an inventive step.

None of the dependent claims contains any additional features which, in combination with the features of the claim to which they refer, involve an inventive step. Said dependent claims relate to

embodiments wherein ancillary features are specified which have not been shown to have a direct bearing on the technical effect and which seem to be within the normal design freedom of the skilled person.

Order

For these reasons, it is decided that:

1. The appeal is dismissed.

The Registrar: The Chairman:

P.Martorana P.A.M.Lançon