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**Datasheet for the decision
of 12 April 2007**

Case Number: T 0444/06 - 3.3.07

Application Number: 01104732.1

Publication Number: 1236501

IPC: B01D 63/08

Language of the proceedings: EN

Title of invention:

Rotary flat membrane separation apparatus

Applicant:

Hitachi Plant Engineering & Construction Co., Ltd.

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step - (no) - (obvious optimisation of dimensions)"

Decisions cited:

-

Catchword:

-



Case Number: T 0444/06 - 3.3.07

D E C I S I O N
of the Technical Board of Appeal 3.3.07
of 12 April 2007

Appellants:

Hitachi Plant Engineering
& Construction Co., Ltd.
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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 29 September 2005
refusing European application No. 01104732.1
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: S. Perryman
Members: G. Santavicca
B. ter Laan

Summary of Facts and Submissions

I. The appeal lies from a decision of the Examining Division refusing European patent application 01 104 732.1 (publication No. 1 236 501), which was filed on 26 February 2001 with a single claim reading as follows:

"1. A rotary flat membrane separation apparatus, comprising:

a plurality of hollow rotary shafts (1);
a plurality of rotary flat membrane disks (2) mounted on each of the plurality of hollow rotary shafts (1) at regular intervals, the plurality of rotary flat membrane disks (2) mounted on adjacent two of the plurality of hollow rotary shafts (1) being alternately arranged side by side in equal intervals; and
a plurality of collars (3), each of the plurality of collars (3) being arranged between adjacent two of the plurality of rotary flat membrane disks (2) mounted on each of the plurality of hollow rotary shafts (1),

wherein a diameter of the collars (3) is between 0.18-0.34 times a diameter of the rotary flat membrane disks (2)."

II. The decision under appeal was based on an amended Claim 1 enclosed in the applicants' letter dated 2 September 2003 as the sole request and reading as follows (emphasis added by the Board):

"1. A rotary flat membrane separation apparatus, comprising:

a plurality of hollow rotary shafts (1);

a plurality of rotary flat membrane disks (2) mounted on each of the plurality of hollow rotary shafts (1) at regular intervals, the plurality of rotary flat membrane disks (2) mounted on adjacent two of the plurality of hollow rotary shafts (1) being alternately arranged side by side in equal intervals; and

a plurality of collars (3), each of the plurality of collars (3) being arranged between adjacent two of the plurality of rotary flat membrane disks (2) mounted on each of the plurality of hollow rotary shafts (1),

characterized in that

the diameter of the collars (3) is between 0.18-0.34 times **the** diameter of the rotary flat membrane disks (2)."

According to the decision under appeal:

- (a) Claim 1 was based on Claim 1 as filed. It had been drawn-up in a two-part form over D1 and it overcame the formal objections raised by the Examining Division.
- (b) No explicit value for the ratio of the diameter of the collars to the diameter of the disks (herein after, c/d ratio) could be found in D1 (JP-A-08309160 ; in the form of its English

translation as submitted by the applicants with their letter dated 2 September 2003) or in D2 (JP-A-2000300968). Moreover, the c/d ratio actually used by the applicants at that time was 0.46. Therefore, the apparatus defined in Claim 1 was novel.

- (c) As regards inventive step, the closest prior art was described in either of D1 or D2. Although the application mentioned that the apparatus aimed at improving the "process amount", the meaning and the relevance of such an effect had not been substantiated by objectively established facts. Since no clear technical effect had been shown to arise from the claimed c/d ratio, the problem to be solved was that of dimensioning an apparatus according to D1 or D2. In doing that, the skilled person would have considered the opposed effects resulting from changing the c/d ratio, such as those regarding structure strength and available surface area. Hence, the choice of acceptable values was nothing more than the finding of an optimum which did not go beyond the normal activity of the skilled person. Therefore, the claimed apparatus lacked an inventive step.

III. On 7 December 2005, the applicants lodged an appeal against that decision. In the statement setting out the grounds of appeal, received on 9 February 2006, the appellants maintained that the claimed subject-matter was inventive and enclosed three annexes:

Annex 1: Constructional drawing of a prior Hitachi Separator;

Annex 2: Prior document showing the technical meaning of the term "process amount", made of pages 1 to 10;

Annex 3: Explanation of different effects.

In reply to the communication in preparation for oral proceedings, in which the Board had made comments *inter alia* on the relevance of the improvements alleged to have been attained over the apparatus of D1, the appellants submitted two further Annexes 4 and 5, concerning respectively a modified version of Figure 2 of the application under appeal, containing more measurement values, and a diagram of test results concerning a comparison over an apparatus according to D1 (letter dated 16 March 2007).

IV. Oral proceedings took place on 12 April 2007, during which the appellants submitted enlarged copies of Figures 2 and 6 of D1.

V. The appellants argued essentially as follows:

(a) The preamble of Claim 1 reflected the prior art as known from D1, which was the closest document. D1 concerned a particular construction of a filter disk that aimed at attaining less clogging and a long life, in particular by ensuring that the liquid permeated evenly the entire surface area of the membrane and not only the central area as in known disk filters.

(b) Starting from D1, the problem to be solved was to provide a rotary flat membrane separation

apparatus that attained less clogging of the effective membrane area and had a long life, and that was simple to construct in order to improve performance such as a higher flux.

- (c) That problem was solved by the characterizing feature of Claim 1, namely a c/d ratio in the narrow range of from 0.18 to 0.34. Figure 2 in the application under appeal showed that only within that range performance was optimal. In a ratio above 0.34 the process amount decreased strongly. This was surprising as the higher rotation speed used at higher c/d ratios was expected to result in a higher flux, hence better performance. Thus, the claimed separator led to a significant increase of efficiency in commercially used processes. The characterizing feature of the invention was a ratio and was applicable to apparatuses of any size. That ratio was independent of the material used, as described in the application. Hence, the problem had been solved over the whole breadth of the claim.
- (d) The solution defined in Claim 1 was not obvious. D1 did not give any indication to change the c/d ratio. Instead, since D1 taught to operate the apparatus at high rotating speeds, where vibration of the disks is likely to occur, the c/d ratio would be higher than 0.4. Hence, D1 taught away from the concept underlying the application under appeal. Also, the more complicated solution suggested by D1 showed worse results compared with the apparatus now being claimed, as could be seen from the operating curves shown in Annex 5.

(e) Since there was no indication in the prior art that by varying the c/d ratio the filter performance might be improved significantly, independently of the construction of the filter disk, and since no indication was available that a c/d ratio in the range of 0.18 to 0,34 provided an unexpectedly good performance, the subject-matter of Claim 1 was inventive.

VI. The appellants request that the decision under appeal be set aside and that a European patent be granted on the basis of the claims and the amended description underlying the decision under appeal.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

The amendments to Claim 1 (two-part form over D1; replacement of the article "a" with the article "the" in the characterizing portion) aim at overcoming the objections raised by the Examining Division and were considered to be allowable. The Board has no reason to take a different position.

3. *Novelty*

The features of the characterizing portion of Claim 1 are not disclosed in D1, nor in any of the other documents on file. Therefore, the claimed subject-matter is novel.

4. *Inventive step*

4.1 The present application concerns a rotary flat membrane separation apparatus. Such an apparatus is known from D1.

4.2 D1 (in its English translation) discloses a construction of a filter plate for a rotary membrane separation device in which a hollow driving shaft formed with a plurality of communicating holes at predetermined intervals in the axial direction is rotatably provided in a casing, a filter plate is fixed to the driving shaft so as to face the communicating hole, a liquid to be filtered that is supplied into the casing is caused to pass through the rotating filter plate and is filtered, and the filtered liquid is discharged through the interior of the driving shaft, characterized in that the filter plate comprises: a support plate formed with a collecting hole in the outer peripheral portion thereof and also formed with a collecting path, which connects the collecting hole to the communicating hole formed in the driving shaft, in the interior thereof, and a filtration membrane with which both surfaces of the support plate are covered via a permeable spacer (Claim 1).

Such a construction is illustrated in Figure 1 of D1, according to which it comprises three hollow rotary shafts (20), each provided with a plurality of rotary filter plates (18) at regular intervals, whereby the plurality of rotary filter plates mounted on two adjacent hollow shafts are alternately arranged side by side in equal intervals (Figure 1 of D1; page 4, paragraphs [0008] and [0009]).

As shown in Figure 2 of D1, the separation device also comprises a plurality of collars (60), each of them being arranged between two adjacent rotary filters mounted on each of the hollow shafts (page 6, paragraph [0014]).

It is apparent from the above that D1 discloses all of the features defined in the preamble of Claim 1 of the application under appeal.

The object of D1 is to provide a construction of a filter plate for a rotary membrane separation device in which the central portion of the filtration membrane becomes less clogged and the service life is long (pages 2 and 3, paragraphs [0003] to [0005]). Since these effects are also sought for by the present application, D1 represents the closest prior art.

- 4.3 D1 does not disclose any dimensions of the filter plate nor of the collar. The particular construction of the filter plate of D1 is therefore not limited to any size nor to the use of any specifically dimensioned collar. Hence, the characterizing features of Claim 1 of the application under appeal are considered to be a selection within the general teaching of D1.

As regards the effects of that selection, the following can be gathered from the present application and from the annexes submitted by the appellants.

Figure 2 of the present application and Figure 2 of Annex 4 show that, although the effective surface area decreases when the c/d ratio is raised from 0.18 to 0.34, the process amount does not decrease. According to paragraph [0012] of the application under appeal as published, this is due to the fact that the operational rotation speed can be increased with the collar diameter. According to Figure 2, a further increase of the c/d ratio beyond the value 0.34 leads to a gradual decrease of the process amount, not a strong one as argued by the appellants. However, Figure 2 concerns a specific filter, having a fixed disk diameter of 750 mm and a collar diameter varying from 100 to 300 mm. No evidence has been provided that the same results would be obtained with filters having different dimensions.

Annex 5 contains no information whatsoever regarding the actual construction of the filters used nor the circumstances of the measurements of the properties it shows. Therefore, it is not possible to understand what the graphs represent and if they are evidence of an improvement over D1. Even the few data mentioned during the oral proceedings do not permit to conclude that Annex 5 represents a proper comparison of the claimed filter with that described in D1. In particular, the choice of a c/d ratio of 0.4 for the apparatus of D1 is the result of a specific interpretation of D1, relying on the fact that D1 aimed at using high rotation speeds. However, D1 does not disclose any c/d ratio and hence

is not limited in this respect, nor regarding the rotational speed. Hence, there is no proof that the claimed subject-matter attains an improved performance over that of D1.

It follows from the above that starting from D1 the problem to be solved can only be seen in providing a rotary flat membrane separation apparatus within the possibilities given by D1, or in other terms in dimensioning the filter apparatus of D1.

- 4.4 The dimensioning of a filter apparatus as claimed takes known goals into consideration, such as high throughput and long life. The skilled person in the field of the present application would therefore aim at increasing the filtering area of the filter disk, its rotation speed, the filter life, as well as at keeping the costs of the filter as low as possible, knowing that some of these objects are contingent in opposing ways on the dimensions of the filter disc and the collar. A low c/d ratio, although the effective membrane area can be large, leads to severe vibration unless the disk is rotated at low speed, which however means low throughput; or, a large c/d ratio leads to low vibration even at high rotation speed, but since the membrane area is small and the collecting resistance of the centrifugal forces is high, the throughput is also small.

Hence, the dimensioning of a rotating filter apparatus as claimed implies by necessity a search for the optimum conditions serving the intended purpose, however hard that work may be.

Routine experimentation may be required to optimise the physical dimensions so as to find a compromise between opposing choices.

The collar diameter can only be larger than the diameter of the shaft on which it is mounted and it should be sufficiently large to ensure stability to the membrane structure, without being close to the diameter of the membrane, in order to ensure a sufficient surface area. This is the interval within which the skilled person would look at when dimensioning the apparatus of D1. Compared to this feasibility interval, the range defined in Claim 1 cannot be considered as narrow and includes the range which the skilled person would investigate in order to dimension an apparatus according to D1, e.g. a ratio comparable to that shown on Figure 2. Therefore, the claimed solution was within the normal reach of a skilled person aiming at dimensioning the apparatus of D1 (in line with the Case Law of the Boards of Appeal of the EPO, 5th edition, 2006 (I.D.8.15), on optimization of parameters).

- 4.5 Consequently, the claimed subject-matter does not involve an inventive step, and a European patent cannot be granted.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

S. Fabiani

S. Perryman