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D E C I S I O N
of 26 March 1999

Case Number: T 0192/97 - 3.2.3

Application Number: 92904708.2

**International
Publication Number:** WO-A-92/21445

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Language of the proceedings: EN

Title of invention:
Inflatable dam for a decanter centrifuge

Applicant:
ALFA LAVAL SEPARATION INC.

Opponent:

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Headword:

-

Relevant legal provisions:
EPC Art. 56, 82

Keyword:
"Inventive step - non-obvious combination of known features"
"Unity - dependent claims"

Decisions cited:

-

Catchword:

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Boards of Appeal

Chambres de recours

Case Number: T 0192/97 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 26 March 1999

Appellant: ALFA LAVAL SEPARATION INC.
955 Mearns Road
Warminster, Pennsylvania 18974-9998 (US)

Representative: Lerwill, John
A.A. Thornton & Co.
Northumberland House
303-306 High Holborn
London, WC1V 7LE (GB)

Decision under appeal: Decision of the Examining Division 2.3.13.100 of
the European Patent Office dated
26 September 1996 refusing European patent
application No. 92 904 708.2 pursuant to
Article 97(1) EPC.

Composition of the Board:

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

Summary of Facts and Submissions

I. With decision of 26 September 1996 the examining division refused European patent application No. 92 904 708.2 in the light of

(D1) EP-A-0 186 761

(D2) US-A-4 575 370 and

(D3) US-A-3 179 334

for reasons of Article 56 EPC.

II. The applicant (appellant) lodged an appeal against the above decision on 13 November 1996 and paid the appeal fee in due time. The statement of grounds of appeal was received on 5 February 1997.

III. The appellant requests to set aside the impugned decision and to grant a patent on the basis of:

-claims: 1 to 12 according to "Annex II"
received on 5 February 1997 (telefax)

-description: pages 1 to 5, 7 to 24 of WO 92/21445
pages 6, 6a received on 20 March 1996

-drawings: sheets 1/10 to 10/10 of WO 92/21445.

IV. Claim 1 according to "Annex II" reads as follows:

"1. A decanter centrifuge comprising:

(a) a bowl (12) rotatable about its longitudinal axis, the bowl comprising a solids discharge (20)

having a weir surface thereon;

(b) a screw conveyor (14) coaxially mounted for rotation within the bowl, the conveyor having a series of conveyor flights extending from a central hub (16) to a position adjacent the inside wall of the bowl;

(c) feed means for introducing a feed mixture into the rotating bowl, the rotation of the bowl subjecting the feed mixture to a centrifugal force, separating the feed mixture into separate layers of solids and liquids dependent upon density;

(d) means for rotating the bowl and the conveyor at a differential speed with respect of one another, such that the conveyor flights continuously move the separated solids layer toward and discharge the solids layer from the solids discharge; and

(e) a bowl hub (22) attached to the bowl, the bowl hub having a series of openings (24) therein forming liquid discharge for separated liquid layer;

characterised in that the decanter centrifuge further comprises an inflatable means (36) positioned adjacent the bowl hub (22) in the form of an annular inflatable bladder (58), inflation of the inflatable means altering the rate of the solids layer discharge by varying the radial position of the discharge of the liquid layer from

the bowl."

V. Appellant's essential arguments can be summarised as follows:

- starting point of the invention is (D1) which document enables the adjustment of weir plates "17" at desired positions without allowing, however, the pond depth in the bowl to be varied during operation of the centrifuge; without exercising hindsight a skilled person would not have equipped the centrifuge according to (D1) with an inflatable means to vary the radial level of liquid discharge;
- (D3) is primarily concerned with separating two liquids and its stack of conical separation discs is rather different to a decanter centrifuge and any comparison with the control of decanter centrifuges to be operated under "above spillover" conditions is not justified; the inflatable weir of (D3) adjusts the interface level during operation of the centrifugal separator thus achieving a safe separation of the heavier and lighter liquid;
- even a combination of (D1) and (D3) would not lead a skilled person to a decanter centrifuge according to claim 1 since no benefit can be seen in applying an inflatable weir to a decanter centrifuge - achieving thereby an advantage of solids discharge - since in a decanter centrifuge the interface between liquids and solids is not well defined;

- (D3), see column 3, lines 50 to 53 also points to a clarifier; in a clarifier solids collect at the periphery of the bowl and can be discharged periodically by opening a valve; controlling the liquid discharge in a clarifier has, however, no influence on the solids discharge;
- (D2), see Figures 4A and 4B, deals with problems arising in a start phase and in a steady phase; it does, however, not disclose an adjustable weir in form of an inflatable annular bladder as claimed in claim 1; an incentive to replace the simple static weir plates according to (D2) can again not be seen so that a combination with other documents would only be contemplated with hindsight;
- whereas in the most common control methods the solids discharge is achieved by varying the differential speed between the conveyor and the bowl, claim 1 is based on continuously varying the radial depth of the liquid within the centrifuge bowl by means of an inflatable dam; since liquid/liquid centrifugal separators do not have a conveying screw no equivalent method of controlling by differential speeds is available, so that a skilled person would not have looked to centrifugal separators and the examining division is wrong in its findings, (see argument of "a bonus effect");
- applying the claimed inflatable means it is possible to substantially increase the control possibilities in comparison with the conventional use of the differential speed of the conveyor

screw and the bowl;

- controlling the pond depth with an inflatable means adjacent the liquid discharge makes it possible to maintain the dryness/concentration of the solids discharge at a desired level despite variation of the feed conditions and quantity; since this possibility has never previously been recognised the subject-matter of claim 1 is seen to be novel and inventive.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments*
 - 2.1 The claim sets according to "Annex II" and "Annex III" filed with the statement of grounds of appeal do not differ in substance so that the decision is based on the claim set according to "Annex II".
 - 2.2 Claim 1 is nearly identical with claim 1 underlying the impugned decision (apart from the insertion of "an" at the beginning of the characterising clause of claim 1). It is not open to an objection under Article 123(2) EPC.
 - 2.3 Dependent claims 3, 6, 7, 8, 10 and 12 have been slightly amended in comparison with the version underlying the impugned decision without infringing the requirements of Article 123(2) EPC.

2.4 Since claims 2 to 12 are **dependent claims** the board cannot share the findings of the examining division in the impugned decision that the requirements of Article 82 PC (unity of invention) are not met, (see "Guidelines C III, 7.8, in which it is clearly set out that **dependent** claims are not open to an objection of lack of unity of invention).

3. *Novelty*

Since novelty is not disputed in the impugned decision and since these findings are fully shared by the board the issue of novelty needs no detailed reasoning.

4. *Inventive step*

4.1 Starting point of the invention is (D1) which document discloses weir plates in a decanter centrifuge which are adjustable in their radial position; an adjustment in use of the decanter centrifuge is, however, not envisaged in (D1) and a continuous adjustment is not possible with the structural means "19, 19" disclosed in (D1).

4.2 Starting from this known decanter centrifuge it is the object of the present invention to facilitate control of a decanter centrifuge during operation, (see present page 6, paragraph 4).

4.3 This object of the present invention is solved with the features laid down in claim 1 in that inflatable means in form of an annular inflatable bladder are positioned adjacent the bowl hub so that the rate of the solids layer discharge is altered by varying the radial

position of the discharge of the liquid layer from the bowl.

4.4 The teaching of claim 1 can also be expressed in that the solids discharge is a function of the radial position of the liquids discharge whereby the latter can be influenced by the inflatable annular bladder.

4.5 (D1) is restricted to a **stepwise** adjustment of the weir plates which is *per se* an obstacle against the functional interrelationship according to above remarks 4.3 and 4.4.

Since the adjustment of the weir plates of (D1) can only be carried out after the centrifuge has been shut down a continuous centrifuge operation mode cannot be achieved so that there is no direct way from (D1) to the claimed decanter centrifuge according to claim 1.

4.6 The further prior art to be considered in combination with the assessment of inventive step is (D2) and (D3).

4.6.1 From (D2) an inflatable dam is not known so that only a selfadjustment of the centrifuge can be derived from (D2), namely a low flow condition according to its Figure 4A during the starting condition of the centrifuge and a normal flow condition according to its Figure 4B in the steady state of the centrifuge. Since a decanter centrifuge has to be run in more than two operation modes, namely start up and steady state, the teaching of (D2), with its lack of control possibilities, is not too helpful for a skilled person in overcoming the inconveniencies of (D1).

- 4.6.2 It is beyond doubt that (D3), published nearly thirty years before the present priority date, *per se* discloses an inflatable discharge weir "44" to control the level of discharge.
- 4.6.3 If at all a skilled person could derive from (D3) that an inflatable weir is a means to vary the level of discharge of a **liquid** since a skilled person would most certainly derive from (D3) that **two liquids** have to be separated in a continuous way, (see its object (s) according to column 1, lines 41 to 50 and the background information according to column 1, lines 17 to 23 of (D3)). It is a fact that two liquids or "phases" are clearly separated by an expressed interface so that conditions prevail which cannot be found in a decanter centrifuge as claimed which is characterised by the separation of liquids/solids, (see conveyor screw for the solids in the present application).
- 4.6.4 The fact that a conveyor screw - which is **a must** in the claimed decanter centrifuge - is not existent in the centrifuge-type disclosed in (D3) clearly shows that (D3) relates to a completely different type of centrifugal separator.
- 4.6.5 In (D3), (see column 3, lines 50 to 53), a "clarifier" is mentioned; even if solids are, however, envisaged in (D3) this document teaches away from claim 1 since in a centrifuge type according to (D3) any solids would be collected in the periphery of the housing and could be discharged only by periodically opening a valve. What is important is, however, that in a clarifier control of the liquid discharge has no influence on the solids

discharge.

- 4.6.6 Under these circumstances it is doubtful whether a skilled person starting from (D1) would at all have turned to (D3) since in a solid/liquid decanter centrifuge no exact separation line exists - in contrast to a liquid/liquid centrifugal separator according to (D3).
- 4.6.7 In the absence of comparable circumstances in separators of the (D3) - type it is not justified to argue with a "bonus effect" as done by the examining division since such an argumentation appears to be the result of inadmissible hindsight. What counts is, however, that it is only by knowing the invention that a skilled person is made aware that an inflatable weir is a means to control via the liquid discharge - i.e. the radius of its level within the bowl - the solids discharge in an infinitely variable and continuous and reliable way.
- 4.6.8 The teaching of claim 1 overcomes the normal approach to control solids discharge in a centrifuge, namely by controlling the differential speed between the conveyor and the bowl.

While this known method is based on an **outside** control in form of the drive means (motor/gear) of the centrifuge present claim 1 is based on an inside control of the decanter centrifuge by activating a weir more or less when the decanter centrifuge is in use.

- 4.6.9 A skilled person is immediately aware that in (D3) no conveyor (screw) for solids is available and that only

a **complete reconstruction** of a centrifuge - either starting from the (D1) - type or starting from the (D3) type - would achieve the decanter centrifuge according to claim 1. A complete reconstruction of a decanter centrifuge without any clear incentive is beyond the normal activities of a skilled person since (D1) and (D3) are based on completely different separation methods and since only by hindsight a skilled person would be led to a combination of them.

4.6.10 *Prima facie* claim 1 is based in its characterising clause only on a structural feature, namely an inflatable means in form of an inflatable bladder which *per se* is known in the art of centrifugal separators.

This feature allows, however, in liquids/solids decanter centrifuges a control method in that the solids discharge is controlled via the radial position of the liquids discharge respectively its radial level within the bowl. The solids discharge can therefore be controlled although the interface between liquids and solids is not very clear in a decanter centrifuge. This implicitly involved control possibility of the inflatable means overcomes any necessity to rely on a differential speed to control the liquids/solids discharge of a decanter centrifuge so that the control mechanism covers a broader control range and is moreover facilitated. With the control feature laid down in present claim 1 the dryness/concentration of the solids discharge can be maintained at a desired level despite variation of the feed conditions and quantity.

4.6.11 Since such a control mechanism of a decanter centrifuge

is not derivable in an obvious way from the available prior art claim 1 is allowable under Article 56 EPC.

4.6.12 The dependent claims cover embodiments of the invention and are all either directly or indirectly linked to the allowable claim 1; present claims 2 to 12 are therefore also allowable.

5. Under these circumstances the impugned decision cannot be upheld. Since the board decides in favour of the appellant a direct decision is possible.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent on the basis of documents according to above remark III of the "Summary of Facts and Submissions".

The Registrar:

The Chairman:

N. Maslin

C. T. Wilson