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D E C I S I O N
of 27 January 1997

Case Number: T 0996/96 - 3.2.3

Application Number: 91920901.5

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IPC: B04C 5/24, B04C 5/28, D21D 5/24

Language of the proceedings: EN

Title of invention:
Hydrocyclone plant

Applicant:
CELLECO HEDEMORA AB

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
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Case Number: T 0996/96 - 3-2-3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 27 January 1997

Appellant: CELLECO HEDEMORA AB
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Decision under appeal: **Decision of the Examining Division 2.3.13.100 of the European Patent Office posted 11 June 1996 refusing European patent application No. 91 920 901.5 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: C. T. Wilson
Members: F. Brösamle
M. Aúz Castro

Summary of Facts and Submissions

I. With decision of 11 June 1996 the Examining Division refused European patent application No. 91 920 901.5 in the light of

(D1) US-A-2 956 679
(D2) US-A-4 190 523 and
(D3) DE-A-2 108 464

for reasons of Article 56 EPC.

II. The Appellant (Applicant) lodged on appeal against the above decision on 16 July 1996 and paid the appeal fee in due time. The Statement of Grounds of Appeal was received on 11 October 1996.

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

- Claims: 1 to 4
- Description: pages 1 to 6
- Drawings: Figures 1 to 4

filed with the Statement of Grounds of Appeal on 11 October 1996.

IV. Claim 1 reads as follows:

"1. A hydrocyclone plant, comprising a great number of hydrocyclones (1) arranged in groups, each group of hydrocyclones being made in one single piece and each

hydrocyclone having an elongated separation chamber (2,5) with two opposite ends, at least one inlet (3) for a liquid mixture to be separated, a light fraction outlet (4) at one end of the separation chamber for a separated light fraction and a heavy fraction outlet (6) at the other end of the separation chamber for a separated heavy fraction, and an inner wall (7), an intermediate wall (9) and an outer wall (8), said walls defining a cylindrical heavy fraction space (10) communicating with the heavy fraction outlet (6), an annular inlet space (11) extending concentrically around the heavy fraction space (10) and communicating with the inlets (3) of the hydrocyclones, and an annular light fraction space (12) extending concentrically around the inlet space (11) and communicating with the light fraction outlets (4), each hydrocyclone extending substantially radially in said annular space, characterised in that:

each group consists of three hydrocyclones; and the groups of hydrocyclones are distributed around the cylindrical heavy fraction space (10) in the circumferential direction of the latter and are spaced from one another in the annular inlet space (11) to allow said liquid mixture to flow between adjacent groups of hydrocyclones."

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

- new Claim 1 is delimited over (D1) whereby the feature that each group consists of three hydrocyclones is derived form originally filed

Claim 2; the amendment to Claim 2 includes the definition that each group of hydrocyclones is accessible and removable from the plant;

- the essential difference *vis-à-vis* the prior art is seen in the orientation and distribution of the groups of hydrocyclones according to Claim 1;

- (D3) discloses only groups of **two** hydrocyclones which are orientated in a direction substantially parallel with the **longitudinal** axis of the central chamber (axially directed hydrocyclones);

- (D1) teaches hydrocyclones in groups arranged in the same plane, namely in flat discs, whereas (D2) teaches an assembly of cast discs carrying radially oriented cyclones;

  the discs are stacked on one another and clamped up together so that the groups in contrast to Claim 1 are distributed in the axial direction;

- though the application in suit addresses the same background as (D2) its solution to the problem of accessibility to the hydrocyclones is different and not rendered obvious by the prior art since the groups only consists of a small number namely three hydrocyclones, distributed in the circumferential direction of the central chamber;

- in contrast to Claim 1 (D3) teaches groups of **two** hydrocyclones substantially directed **axially** so that pipes are necessary to combine the different

levels; pipes are, however, seen as disadvantageous since they obstruct access to the hydrocyclones especially in cases of large numbers thereof within one plant; (D3) is therefore not helpful for the solution of the application's problem since its basic teaching is cancelling the particle rotation and wear on the cyclone walls; (D3) is seen as directly contradictory to the teaching of Claim 1 since the claimed mini-groups of three cyclones are unable to avoid a rotating swirl;

- only with inadmissible hindsight of the prior art according to (D1) to (D3) could a skilled person derive a hint towards the hydrocyclone plant of Claim 1;

- summarizing, the impugned decision should therefore be set aside and the patent granted.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 Claim 1 comprises all the features of originally filed Claim 1 without the feature "arranged in groups of at **least two** hydrocyclones", see second and third line thereof.

This feature is replaced by the feature "each group consists of **three** hydrocyclones" being clearly disclosed in originally filed Claim 2, Figure 3 and page 3, line 12.

The features "inner wall (7), intermediate wall (9) and outer wall (8)", (see preamble of Claim 1) and "annular inlet space (11)", (see characterizing clause of Claim 1), are clearly disclosed in Figure 1 as well as on page 3, lines 19 to 24 of the description originally filed.

Summarizing, Claim 1 in not open to an objection under Article 123(2) EPC.

2.2 This is also true for Claims 2 to 4 which are based on part of Claim 2, Figures 1/2 and page 4, lines 6 to 8 as well as on Claims 3 and 4 as originally filed.

3. *Novelty*

3.1 Claim 1 is correctly delimited over the nearest prior art document (D1), Rule 29(1) (a) EPC, so that the characterizing features of Claim 1, namely

(a) three hydrocyclones per group

(b) distribution of the groups in a circumferential direction of the heavy fraction space and

(c) spacing of the groups, in the annular inlet space such that liquid is allowed to flow between adjacent groups of hydrocyclones

are not known from (D1).

3.2 (D2) is already further away from the subject-matter of Claim 1 since it is not known therefrom to arrange hydrocyclones in groups thereby maintaining the possibility of free flow of the liquid mixture to be cleaned between adjacent groups.

3.3 (D3) differs from the subject-matter of Claim 1 by its **axial** arrangement of hydrocyclones and the central inlet of the liquid mixture to be cleaned.

3.4 Summarizing the above findings none of the documents (D1) to (D3) is novelty - destroying of the subject-matter of Claim 1, Article 54 EPC.

4. *Inventive step*

4.1 The nearest prior art (D1) is characterized by an arrangement of hydrocyclones in one plane and at an angle of 180° or so (opposite direction), (see column 1, lines 27 to 35 and lines 44 to 47 as well as column 2, lines 19 to 23 of (D1)).

(D1) is silent about the aspect of compactness and servicing of the individual hydrocyclones.

4.2 Starting from (D1) the objectively remaining technical problem of the invention according to Claim 1 has to be seen in creating a hydrocyclone plant which is compact, suited for relatively long hydrocyclones and enables

easy servicing of the individual hydrocyclones, (see page 2, paragraph 3 of the description filed with the Statement of Grounds of Appeal).

4.3 The above object of the invention is solved with the features according to Claim 1, namely by grouping the hydrocyclones, by distributing these groups in a circumferential direction of the heavy fraction space and by allowing the liquid mixture to freely flow between adjacent groups of hydrocyclones in the annular inlet space of the liquid mixture, (see also above remark 3.1).

4.4 With the features of Claim 1 a **compact** arrangement of hydrocyclones within a **limited** space is achieved; due to the radial arrangement of the groups with respect to the central heavy fraction space the possibility of exchanging individual groups of hydrocyclones is enabled so that **servicing** thereof is no longer problematic; finally the spaced arrangement of said groups allows the elimination of **any inlet tubes** for the individual hydrocyclones so that this feature also contributes to the compactness of the hydrocyclone plant.

4.5 For the following reasons the Board comes to the result that Claim 1 is based on an inventive step:

4.5.1 The drawbacks of (D1) are already set out in above remark 4.1, namely bulky arrangement of the **individual** hydrocyclones due the angle of about 180° between them, which leads to a poor degree of compactness.

4.5.2 It could be argued that **more** hydrocyclones in one plane would overcome the above drawback of the (D1) - plant but it is obvious that an angle of substantially smaller than 180° only achieves a limited result with respect to the teachings of Claim 1 which inter alia offers the possibility of escaping from one single plane by the arrangement of **three** hydrocyclones in a group, (see Figure 3 of the application in suit in particular).

4.5.3 What remains, however, unchanged in the case that **more** hydrocyclones are arranged in one plane is the complicated inlet situation according to **Figure 1** of (D1), namely tubes, channels, etc.

The second alternative of (D1) according to Figure 2 enables the elimination of the said tubes, channels, etc., but is still restricted to **only two** hydrocyclones per plane though the liquid mixture to be cleaned can freely enter the space between the two hydrocyclones according to Figure 2 of (D1).

4.5.4 A skilled person **not knowing** the invention would therefore not be led by (D1)to enhance the compactness and servicing aspect of a hydrocyclone plant as claimed in Claim 1.

4.5.5 (D2) overcomes some of the disadvantages of (D1) which is dealt with in (D2) as prior art, (see column 1, lines 12 to 25 and column 2, lines 13 to 19), namely by arranging more than two hydrocyclones in one plane,

(see above remark 4.5.2), but (D2) still suffers from a poor degree of compactness when compared with the subject-matter of Claim 1.

4.5.6 The crucial point to be considered in combination with (D2) is, however, the way in which the enhancement of the degree of compactness is achieved in (D2), namely by using discs "1,1'" which tend to be detrimental to bigger hydrocyclone plants due to their space requirements.

Even if (D2) were to be considered by a skilled person as a document which teaches an increased degree of compactness and considers the aspect of servicing, a skilled person would be led to a disc-construction which entails serious drawbacks such as big space requirements and heavy weight both being an obstacle to improve the hydrocyclone plant along the lines of the object set out under above remark 4.2.

4.5.7 From (D3) which teaches hydrocyclones arranged in contrast to the teachings of Claim 1 in an **axial** direction it can **per se** be derived that in the technical field of hydrocyclone plants it is known to arrange **two** hydrocyclones "9,9" in a group, (see in particular Figures 2 and 3 of (D3)). The arrangement of these groups in different levels leads, however, to the necessity of escape tubes "15, 15" which again are an obstacle to a further increase of the degree of compactness.

4.5.8 The aspect of servicing is not considered or dealt with in (D3) so that a skilled person **not knowing** the invention would not turn to (D3) to get information about the possibility to solve the issue of servicing of individual hydrocyclones.

4.5.9 Even if a skilled person turned to (D3) he would have to decide whether the horizontal or the vertical arrangement of hydrocyclones should be realized and whether the inlet configuration of Figure 1 or Figure 2 of (D1) should be maintained, (see above remark 4.5.3, when seen in combination with (D3)).

The relatively easy outlet configuration for the light fraction according to (D1), namely annular chamber "8", would be particularly complicated if carried out with tubes as taught in (D3).

4.5.10 What would still not be achieved is the grouping of **three** hydrocyclones since (D3) is restricted to a teaching of grouping only two hydrocyclones.

4.5.11 Summarizing, a skilled person could derive from (D2) and (D3) some features claimed in Claim 1 but it is extremely doubtful that the combination of features laid down in Claim 1 could be achieved with documents (D1) to (D3) without knowing the claimed invention. A skilled person had to do more than simply combine teachings of prior art documents to achieve the subject-matter of Claim 1 since the claimed plant according to Claim 1 has to be seen as a complete reconstruction of a hydrocyclone plant.

4.5.12 Under these circumstances Claim 1 defines novel and inventive subject-matter within the meaning of Articles 54 and 56 EPC and is allowable.

4.5.13 Claims 2 to 4 are also allowable as dependent claims.

5. As a consequence of the above findings the impugned decision cannot be upheld.

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 Claims 1 to 4, description, pages 1 to 6 and Figures 1 to 4, all documents submitted on 11 October 1996.

The Registrar: The Chairman:

N. Maslin C. T. Wilson