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D E C I S I O N
of 22 September 1998

Case Number: T 0997/96 - 3.2.4

Application Number: 93107390.2

Publication Number: 0569863

IPC: F04D 29/32

Language of the proceedings: EN

Title of invention:
High efficiency, low axial profile, low noise, axial flow fan

Applicant:
Siemens Canada Limited

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 83, 123(2)

Keyword:
"Disclosure - sufficiency (yes)"
"Amendments - explanatory (no added subject-matter)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0997/96 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 22 September 1998

Appellant: Siemens Canada Limited
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Representative: Allen, Derek
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 9 May 1996 refusing European patent application No. 93 107 390.2 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: C. A. J. Andries
Members: H. A. Berger
J. P. B. Seitz

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal, received on 8 July 1996, against the decision of the examining division, dispatched on 9 May 1996, refusing the application No. 93 107 390.2. The appeal fee was also paid on 8 July 1996. The statement setting out the grounds of appeal was received on 30 August 1996.

II. The examining division came to the conclusion that the application did not meet the requirements of Articles 83 and 123(2) EPC, and that claims 1 and 2 did not meet the requirements of Article 84 EPC.

III. The appellant has cited the following documents in support of the view that the terminology used in the originally filed application is indeed conventional:

D1: US-A-4 569 632

D2: US-A-4 358 245

D3: US-A-5 244 347 (publication date: 14 September 1993; priority date of the present application: 15 May 1992).

D4: "Axial Flow Fans and Ducts" by R. Allan Wallis, John Wiley & Sons, Inc., New York, 1983, pages 143 to 176.

D5: "Fan Engineering: An Engineer's Handbook", edited by Robert Jorgensen, published by Buffalo Forge Company, New York, seventh Edition, 1970, pages 217 to 229.

D6: Affidavit of Professor Terry Wright, dated 9 March 1998.

D7: Paper by R.A. Cumming et al., "Highly Skewed Propellers", Vol. 80, 1972, (presented at the Annual Meeting, New York, 16 and 17 November 1972, of The Society of Naval Architects and Marine Engineers), pages 98 to 135.

D8: Paper by Neal A. Brown, "The Use of Skewed Blades for Ship Propellers and Truck Fans", pages 201 to 207, presented during the symposium on "Noise and Fluids Engineering", at the ASME Winter Annual Meeting, 27 November to 2 December 1977.

D9: Paper by T. Wright and W.E. Simmons, "Blade Sweep for Low-Speed Axial Fans", ASME Journal of Turbomachinery , January 1990, Vol. 112, pages 151 to 158.

D10: Affidavit of David Hendrickson, dated 10 March 1998.

IV. In response to communications of the board and to a telephone conversation the appellant has filed with letter of 10 August 1998 and with facsimile of 19 August 1998 amended claims 1 and 2, amended pages 4, 5 and 5a of the description and an amended Figure 9.

V. Claim 1 as now on file reads as follows:

"A one-piece high efficiency, low axial profile, low noise, axial flow fan (10) comprising
a hub (12) that is rotatable about an axis (14),
a plurality of skewed, airfoil-shaped fan blades (16) distributed circumferentially around said hub (12) and extending both radially and axially away from said hub (12),

each blade (16) having a root (16R) joining with said hub (12), and circular band (18) that is concentric with and spaced radially outwardly from said hub (12), each blade (16) having a crest (16C) joining with said band (18),

and wherein the axially rearward face of said hub (12), the axially rearward edge of said band (18) and the tails of said blades (16) occupy a common plane that is perpendicular to said axis (14),

and in which each of said blades (16) is constructed substantially in accordance with parameters defined as

R (p.u.)	C (p.u.)	θ (deg.)	ε (deg.)	Y OFFSET (mm)	SKEW ANGLE (adjusted)
0.43	0.87	42	71.7	0	0.0
0.50	0.80	27	75.6	0	2.5
0.57	0.67	19	75.9	0	3.7
0.64	0.54	18	75.8	0	2.4
0.72	0.47	17	74.9	0	0.9
0.79	0.40	17	73.1	0	-1.2
0.86	0.34	17	72.3	0	-4.4
0.93	0.29	17	72.3	0	-8.0
1.00	0.23	20	72.8	0	-15.4

wherein R (p.u.) is the radial distance (per unit) from the axis (14) as a fraction of the maximal blade radius,

C (p.u.) is the chord length (per unit) of the blade's airfoil-shaped cross section at the corresponding radial distance as a fraction of the cross section's radial distance,

θ is the camber angle of the cross section,

ϵ is the stagger angle of the cross section, and

Y OFFSET is measured between the trailing edge of the cross section and the back of the hub (12)."

Claim 2 as now on file is dependent on claim 1.

VI. Request

The appellant requests that the decision under appeal be set aside and that the application be remitted to the first instance for further prosecution on the basis of the following documents:

Claims: 1 and 2 filed with the facsimile of 19 August 1998;
3 and 4 filed with the letter of 19 September 1995.

Description: Pages 1 to 3 as originally filed,
pages 4 and 5a filed with the letter of 10 August 1998,
page 5 filed with the facsimile of 19 August 1998.

Drawings: Figures 1 to 8, 10 and 11 as originally filed,
Figure 9 filed with the facsimile of 19 August 1998.

Reasons for the Decision

1. The appeal is admissible.

The decision of the examining division only deals with the claims 1 and 2, the description and the drawings with respect to Articles 83, 84 and 123(2) EPC. The claims 3 and 4 are not covered by this decision. Also the statement of grounds of appeal does not deal with these claims 3 and 4. Thus, the appeal is solely concerned with the claims 1 and 2, the description and the drawings with regard to the amendments (Article 123(2) EPC), the disclosure of the invention (Article 83 EPC) and the clarity of the claims 1 and 2 (Article 84 EPC).

2. *Amendments (Article 123(2) EPC)*

2.1 Claim 1:

The first portion of claim 1 is disclosed in the originally filed claim 1. The remaining portion describing the configuration of each blade is disclosed as follows:

The table as such is based on the table shown in Figure 11 (see originally filed page 5, lines 2 and 3).

The radial distance parameter R is disclosed on originally filed page 5, lines 4 and 5.

The parameters C, θ and ϵ of an air foil shaped blade profile are indicated in the originally filed Figure 7 and their definitions are derivable therefrom. The terms "chord length", "camber angle" and "stagger angle" are conventional nomenclature (see publication D5, pages 217 and 218 for "chord length" and "stagger

angle", and publication D4, page 150 for "camber angle" and page 170 in connection with Figure 6.4 on page 150 again for "stagger angle").

The Y OFFSET is explained on originally filed page 5, lines 6 to 12 in conjunction with Figure 8.

The SKEW ANGLE is depicted in Figure 9.

2.2 Claim 2:

Claim 2 is based on originally filed Figure 10, which is mentioned on originally filed page 5, lines 1 and 2. The definitions of the various parameters R(mm), C(mm), θ(deg.), ε(deg.), Y OFFSET(mm) and SKEW ANGLE(deg.), are derivable from the originally filed application as indicated above with reference to Claim 1.

2.3 Description:

Page 4 corresponds to originally filed page 4 save for part of the last full sentence which has been transferred to page 5. The content of pages 5 and 5a is originally disclosed as follows: The leading and trailing edge tangent lines referenced with respect to the circular arc camber line are shown in originally filed Figure 7 for a particular cross section of the airfoil. The term "camber line" is conventional terminology (see document D4, page 143 and Figure 6.5 on page 153, and page 158 for "circular arc camber"; see also document D5, page 217 and Figure 96 on page 218). It is also derivable from Figure 7 that θ is the camber angle between the leading and trailing edge tangent lines. The term "camber angle" is a common definition in this field (see document D4, pages 150 and 158). It is furthermore derivable from Figure 7 that ε is the angle between the line C and (according to the content of the application) a line parallel to

the axis of rotation. The line C is commonly known as the chord line (see document D4, Figure 6.5 on page 153; document D5, page 217). The term "stagger angle" is common nomenclature (see document D4, Figure 6.4 on page 150, in conjunction with page 170; and document D5, page 217).

The part of the description relating to Figure 8 is derivable from originally filed Figure 8 and the originally filed page 5, lines 6 to 9.

The part of the description relating to Figure 9 is derivable from originally filed Figure 9. Figure 9 is a schematic drawing, not reflecting the numerical values of Figures 10 and 11. The skew angle can be defined in more than one way. Figure 9, however, clearly discloses the skew angle ϕ as the angle between a fixed radial reference line passing through the centre of the hub, and a radial line through both the centre of the hub and the centre line of the blade at the cross section in question. In Figure 11 [see section A] this reference line has been rotated to cross the blade centre line at the blade root section. In document D7 the paragraph bridging the two columns on page 99 supports the definition of the skew angle ϕ according to Figure 9 and confirms that the skew angle ϕ of Figure 9 conforms to a common definition of skew angle in this technical field.

The centre line of the skewed blade profile of Figure 9 is understood by the board to be the mid-chord line, i.e. a line that passes through the respective centres of the chord lengths C for the various cross sections A - I of the blade (Figures 1 and 7). This view is supported by document D10, page 3 and document D6, page 2, third paragraph; page 3, fourth paragraph, and in prepublished paper D7, page 124, right hand column; page 131, left hand column, second and third paragraph;

and the drawings on pages 132 and 133. The reproduction of a skewed blade profile on the basis of the values disclosed in Figures 10 and 11, only seems plausible with a skew angle referring to the mid-chord line, since the chord length is given for each section; this information only making sense when serving to assist in constructing the centre line (see document D10).

The part of the description relating to Figures 10 and 11 is derivable from the originally filed page 4, last line to page 5, line 3 and from Figures 10 and 11 in conjunction with Figure 1 (sections A to I). The non-dimensional radial distances (p.u.) can be derived by dividing each of the radial distances of the sections (A to I) by the maximal radial distance of section I (168.5mm). The non-dimensional chord lengths (p.u.) can be derived by dividing each of the chord lengths of the sections (A to I) by the radial distances of each of these sections (A to I). The description concerning the offset values is based on originally filed page 5, lines 9 to 12 in conjunction with Figures 3, 8, 10 and 11.

The description on page 5a, second paragraph, concerning the airfoil-shaped cross section and the Y offset is based on originally filed page 5, lines 4 to 12 and on Figures 1 and 8. The last paragraph of page 5a corresponds to the last paragraph of originally filed page 5.

2.4 Drawings:

Figures 1 to 8, 10 and 11 are disclosed in the originally filed application. Figure 9 is based on the originally filed Figure 9 wherein the two left most dashed lines have been cancelled, since they are not necessary for the explanation of the skew angle and are not mentioned in the originally filed description.

2.5 The amendments, therefore satisfy Article 123(2) EPC.

3. *Disclosure of the invention (Article 83 EPC)*

The application discloses the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art, who is familiar with the definitions in the field of blade profiles and the construction of blades (see above sections 2.1 and 2.3). To the board this is furthermore convincingly supported by document D10.

The application therefore satisfies Article 83 EPC.

4. *Clarity of claims 1 and 2 (Article 84 EPC)*

In view of the explanations given in above sections 2.1 and 2.3, claims 1 and 2 clearly and concisely define the fan for which protection is sought and are supported by the description. The board therefore sees no violation of Article 84 EPC by the claims 1 and 2.

5. *Novelty and inventive step of the subject-matter of claims 1 and 2*

Novelty and inventive step of the subject-matter of claims 1 and 2 are not discussed in the decision under appeal and are therefore not taken into consideration during this appeal procedure. They therefore still have to be examined by the first instance during the further prosecution of the case.

6. *Claims 3 and 4*

Claims 3 and 4 were not discussed at all in the decision under appeal, so that these claims also are not taken into consideration during this appeal procedure. Claims 3 and 4 should therefore be examined by the first instance with respect to the European Patent Convention. It should be considered that these claims are independent claims.

7. The board draws the attention of the first instance to minor necessary corrections in the drawings, namely the numbering of the sheets (six instead of five) and the cancelling of Figure 9 on the originally filed sheet 4/5.

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 for further prosecution on the basis of the following documents:

Claims: 1 and 2 filed with the facsimile of 19 August 1998;
3 and 4 filed with the letter of 19 September 1995.

Description: Pages 1 to 3 as originally filed,
pages 4 and 5a filed with the letter of 10 August 1998,
page 5 filed with the facsimile of 19 August 1998.

Drawings: Figures 1 to 8, 10 and 11 as originally filed,
Figure 9 filed with the facsimile of 19 August 1998.

The Registrar: The Chairman:

N. Maslin C. Andries