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**Datasheet for the decision
of 10 January 2019**

Case Number: T 1452/15 - 3.2.04

Application Number: 01918835.8

Publication Number: 1208303

IPC: F04D29/32, F04D29/38

Language of the proceedings: EN

Title of invention:
COOLING FAN

Patent Proprietor:
BorgWarner, Inc.

Opponent:
MAHLE Behr GmbH & Co. KG

Headword:
Cooling fan/BORGWARNER

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
Novelty - main and first auxiliary requests (no)
Inventive step - 2nd auxiliary request (no) 3rd auxiliary
request (yes)

Decisions cited:

T 0204/83

Catchword:



Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 1452/15 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 10 January 2019

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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted on
22 May 2015 concerning maintenance of the
European Patent No. 1208303 in amended form.

Composition of the Board:

Chairman A. de Vries
Members: J. Wright
W. Van der Eijk
E. Frank
T. Bokor

Summary of Facts and Submissions

I. The appellant-proprietor lodged an appeal, received 22 July 2015, against the interlocutory decision of the Opposition Division posted on 22 May 2015 concerning maintenance of the European Patent No. 1208303 in amended form. The appellant-proprietor paid the appeal fee at the same time. Their statement setting out the grounds of appeal was filed on 21 September 2015.

The appellant-opponent also lodged an appeal, received 22 July 2015, against the interlocutory decision and paid the appeal fee simultaneously. Their statement of grounds of appeal was filed on 30 September 2015.

II. The opposition was filed against the patent as a whole and based on added subject matter, lack of novelty and lack of inventive step. The opposition division decided, amongst other things, that the subject matter of claim 1 according to a first auxiliary request (identical to claim 1 as granted), lacked novelty vis-à-vis D1 (EP0515839 A) and that the patent as amended according to a second auxiliary request met all the requirements of the EPC.

III. Oral proceedings were duly held before the Board on 10 January 2019.

IV. The appellant-proprietor requests that the decision under appeal be set aside and the European patent No. 1208303 be maintained as granted (main request) or, in the alternative, on the basis of one of first to fifth auxiliary requests, filed with letter of 19 December 2014.

V. The appellant-opponent requests that the decision under appeal be set aside and that the European patent be revoked.

VI. Claim 1 of the requests relevant for this decision reads as follows:

Main and first auxiliary requests:

"An engine driven cooling fan (10) for use in an engine cooling system, the fan (10) comprising:

a central hub (12); and

a plurality of fan blades (11) projecting radially outwardly from the hub (12), each of the blades (11) having a blade root (19) connected to the hub and a blade tip (17) at an opposite end thereof, and each of the blades (11) defining a leading edge (11a) at an inlet side (10a) of the fan and a trailing edge (11b) at an outlet side (10b) of the fan, the blades (11) further defining a front face (22) directed toward the inlet side (10a) of the fan (10) and an opposite rear face (25) directed toward the outlet side (10b) of the fan (10);

characterised [sic] in that

each of said blades (11) includes a support vane (30) attached to said rear face (25) thereof, said support vane (30) having a first end originating adjacent said blade root (19) and said leading edge (11a), and an opposite second end terminating at said trailing edge (11b) between said blade root (19) and said blade tip (17)".

Second auxiliary request: claim 1 reads as claim 1 of the main request (as granted), but adds the following wording to the end of the claim:

"; and
wherein the support vane (30) is curved between said first end and said second end, wherein said support vane (30) is curved to correspond to the airflow' path (F) across said rear face (25) of each of said fan blades (11); and wherein each of said plurality of fan blades (11) defines a blade length between said root (19) and said tip (17); and
said support vane (30) terminates at a position on said trailing edge (11b) approximately one-third of said blade length from said blade root (19)".

Third auxiliary request: claim 1 reads as claim 1 of the main request (as granted), but adds the following wording to the end of the claim:

"; and
further comprising a circumferential support ring (35) attached to said hub (12) adjacent said blade root (19) of said plurality of fan blades (11), wherein said first end of said support vane (30) is attached to said support ring (35); and
a vane support superstructure (37) connected between said support ring (35) and said support vane (30) between said first end and said second end thereof, wherein said support vane (30) is curved between said first and said second end and wherein said vane support superstructure (37) includes an angled rib (47) projecting substantially perpendicularly from said support vane (30) at a middle position of said support vane (30)".

VII. The appellant-proprietor argued as follows:

D1 does not take away novelty of claim 1 of the main and first auxiliary requests because D1 does not

disclose a support vane as claimed. It only has a hub ramp which is part of the hub.

The subject matter of claim 1 of the second auxiliary request is new and involves an inventive step with respect to D1. D1 does not disclose the support vane to extend 1/3rd up the length of the blade's trailing edge, nor is this obvious for the skilled person.

The subject matter of claim 1 of the third auxiliary request is new and involves an inventive step.

VIII. The appellant-opponent argued as follows:

D1 renders claim 1 of the main and first auxiliary requests not novel. The hub ramp of D1's fan is a support vane as claimed.

The subject matter of claim 1 of the second auxiliary request is not new with respect to D1. Even if it were considered that D1 did not disclose the feature of the support vane extending to 1/3rd of the blade length, the skilled person would inevitably arrive at the feature which is merely determined by (non-claimed) operating conditions and blade geometry.

Claim 1 of the third auxiliary request adds subject matter. Its subject matter is not new, nor does it involve an inventive step with respect to D1.

Reasons for the Decision

1. The appeal is admissible.
2. Background

- 2.1 In most industrial and automotive engine applications, an engine-driven cooling fan is used to blow air across a coolant radiator (see published patent specification, paragraph [0002]). The invention concerns such a cooling fan (see published patent specification, paragraph [0001] and all versions of claim 1).

- 2.2 An important feature of the detailed embodiment (see published patent specification, paragraph [0025] with figures 2 and 6, in particular reference numeral 30) is a support vane on the rear face of each fan blade.

3. Main request, novelty with respect to D1

- 3.1 D1 discloses (see abstract and figure 1) an engine driven cooling fan 1 for use in an engine cooling system. The fan comprises: a central hub 2; and a plurality of fan blades 3 that project radially outwardly from the hub 2, each of the blades having a blade root connected to the hub and a blade tip at an opposite end. Each of the blades (see column 3, lines 10 to 18) has a leading edge 8 at an inlet side of the fan and a trailing edge 9 at an outlet side of the fan. The blades further define a front face directed toward the inlet side (see column 3, lines 18 to 22 with arrow 11) of the fan and an opposite rear side 3a directed toward the outlet side.

- 3.2 In the Board's opinion, D1 also discloses (see column 1, lines 46 to 54) that each of the blades 3 includes a support vane, referred to in D1 as a "Nabenrampe" 4, that is attached to the rear face of the blade as claimed. Therefore D1 takes away novelty of claim 1.

3.3 It is true that D1 consistently uses the term "Nabenrampe" which translates as "hub ramp". Thus the ramp could be construed as forming part of the hub. Certain passages of D1 are also consistent with this (see for example the abstract). However, other passages appear to disclose the hub ramp as not being part of the hub (see for example column 1, lines 47 to 50: "auf der Druckseite der Luftschaufeln ... eine Nabenrampe vorgesehen", i.e. the hub ramp is provided on the pressure side of the blades; column 3, lines 3 to 5: "Diese Nabenrampe ist unmittelbar angrenzend an die Nabe vorgesehen", this hub ramp is provided directly adjacent to the hub). It is therefore at least ambiguous as to whether D1 presents the ramp as part of the hub or of the blade.

Leaving this ambiguity aside, in the Board's view, the hub ramp is a support vane in all but name. In this respect, the Board notes that D1 (see column 2, lines 14 to 20) discloses that the hub ramp 4 improves [air] flow, thus functions as a vane. It is also disclosed there as increasing stability in the region of the blade root, so the ramp supports the blade. In other words the hub ramp is a support vane, whether or not D1 discloses it as part of the hub.

3.4 Furthermore, the Board is of the opinion D1 discloses the hub ramp 4 (which is a support vane) as having all the features of the support vane defined in claim 1.

3.5 The hub ramp 4 can best be seen in figure 1, which shows the rear (pressure) side of the fan. The hub ramp 4 spans the width of each blade 3. Furthermore (see for example, column 1, lines 47 to 54, column 2, last line to column 3, line 3 and claim 1) each respective hub ramp is said to be "auf der Druckseite der

Lüfterschaufeln" - on the pressure side of the fan blades. It is true that, read in isolation, this expression could either mean that the hub ramp is located somewhere in the space behind the fan blades (as the appellant-proprietor would have it), or that the hub ramp is directly on the rear side of the fan blade. In the Board's view, when the skilled person reads the expression in context and studies the figures with a mind willing to understand, only the latter interpretation is possible.

3.6 D1 (see column 3, lines 10 to 13) describes the outer side 7 of the hub ramp 4 as extending from the leading edge 8 to the trailing edge 9 of each fan blade 3. In other words the hub ramp 4 extends on the rear side of the fan blade 3. Given, furthermore (see column 1, lines 1 to 7, column 2, lines 32 to 34 and 40 to 42, column 3, lines 8 to 9, column 4, lines 12 to 14), that the fan, with its blades and hub, is made as a single piece, the hub ramp 4 can but be attached to the rear face of the blade 3 as claimed.

3.7 Furthermore, in the Board's view, the hub ramp originates adjacent the blade root and leading edge.

It is true that D1, figure 1 shows (cf. impugned decision, point 4.5) the hub ramp 4 of a particular blade to originate at the trailing edge of the adjacent blade in the direction of fan rotation 5. However, since the leading edge of the particular blade almost touches the trailing edge of the adjacent blade at their blade roots, the hub ramp also originates *adjacent* the blade root and leading edge.

3.8 It appears not to be in dispute that the hub ramp terminates at the blade's trailing edge (see figure 1).

In the Board's opinion, it does so between the blade's root and its tip. In other words the blade's trailing edge 9 extends downwards beyond the end of the hub ramp 4. In this respect, the Board does not agree with the appellant-proprietor's conjecture that D1 discloses that the supporting framework, with its connecting ribs 13 and 14, extends axially outwards beyond the front side of the fan blade 3, an arrangement which is nowhere shown or described in D1.

3.8.1 Firstly, the Board notes that the hub ramp is consistently described as being on the pressure side of the fan blade (see for example D1, abstract, column 1, lines 46 to 54, sentence bridging columns 2 and 3, column 3, lines 24 to 29 and claim 1). The corollary of this is that the ramp is not on the front side of the blade.

Secondly, (see again column 3, lines 24 to 29), the hub ramp ascends along an imaginary interface between what (in the absence of the hub ramp) would constitute [laminar] mixed flow (Halbaxialströmung) and the [turbulent] stagnation region (Totwassergebiet) on the rear face of the vane. Like the laminar flow region, this imaginary stagnation flow region would be behind the rear face of the lower part of the blade if it wasn't for the hub ramp on that side. This is indeed the main purpose of the hub ramp in D1, column 1, 2nd and 3rd paragraphs. There is no indication that this problem occurs on the front facing side of the blades. Clearly, the main locus of the ramp will be limited by the area on the blade in which stagnation occurs. Thus, rather than the structure that supports the blade ramp on the pressure side extending through and beyond the front of the blade, it can only be located on the

pressure side of the blade. Nor is there any indication in D1 that might lead the Board to conclude otherwise.

The Board therefore deduces that the hub ramp, running along its imaginary flow-boundary line, does not follow the blade root but ascends to a point which is somewhere between the blade root and blade tip as claimed.

3.8.2 In this respect, the Board is not convinced by the appellant-proprietor's argument that this deduction is incompatible with the presence of the connecting rib 13 (Verbindungssteg 13) as shown in figure 1 and in conjunction with column 3, lines 42 to 50 and figure 2).

That the rib 13 is aligned (fluchtend) to the trailing edge 9 of the blade 3 could either mean it is aligned in the sense that the rib 13 starts where the blade ends (as the appellant-proprietor would have it), or it could mean it is aligned in parallel to the trailing edge 9. In the Board's view, only the latter can be true. The rib 13 is the means by which the rising wall 12 of the hub ramp is supported on the outer circumference of the hub 2 (see column 3, lines 42 to 50). The rib 13 would only be able to provide such support by running between the underside of the hub ramp's wall 12 and the hub 2, therefore it must run parallel to the trailing edge 9, rather than directly underneath the blade.

Thus, the detailed explanation of the rib 13 with figure 1 leads the skilled person to conclude that the rib 13 runs parallel to the trailing edge 9. In the Board's view, the skilled person would not reject this

conclusion because of how the blade is shown in figure 2, as the appellant-proprietor has argued.

It is true that figure 2 does not show the rib 13, but this is because it is a section along the line II-II (see figure 1) at the outer end of a single blade looking inwards towards the hub. Consequently, the view is of the radially outward surface 7 of the ramp, with the support structure including rib 13 hidden from view. Nor is the Board convinced that there would be no space for the rib under the ramp. It may be that figure 2 is somewhat inconsistent in its depiction of the ends of the ramp in relation to the edges of the blade. This however appears to be an artefact due to the simplified, schematic nature of the view. In any case the Board is unable to deduce from such inconsistency that there would not be enough space for a rib underneath the ramp and adjacent the blade where the ramp meets the trailing edge of the blade, and that therefore the rib must extend to the other side of the blade as the appellant-proprietor interprets figure 2. It is also difficult to reconcile such an interpretation with an alternative embodiment in D1 (see column 3, lines 34 to 41) in which the hub ramp is not formed integrally with blade and hub but is snapped on and exchangeable according to requirement.

- 3.9 For the above reasons, the Board concludes that the hub ramp 12 is a support vane as claimed. Therefore, D1 discloses all features of claim 1 of the main request and first auxiliary request. Consequently, these requests must fail.
4. Novelty and inventive step, second auxiliary request, claim 1

4.1 According to established jurisprudence, see Case Law of the Boards of Appeal, 8th edition, 2016 (CLBA) I.C.4.6, and T 204/83 (Headnote), features shown solely in a drawing form part of the state of the art when a person skilled in that art is able, in the absence of any other description, to derive a technical teaching from them.

4.2 Claim 1 of the second auxiliary request adds to granted claim 1 features which can be summarised as:

- the support vane is curved between first and second ends,
- the support vane is curved to correspond to the airflow path across the rear face of each fan blade, and
- the support vane terminates on the trailing edge approximately one-third of the blade length from the blade root"

4.3 In the Board's view, D1 (see figure 1) discloses that the hub ramp 12 (support vane in the words of claim 1) is curved. Although D1's description does not state this, the skilled person will immediately see that each of the eight hub ramps shown in figure 1 is unmistakably curved, not straight. He would thus not ignore this curved shape as somehow coincidental and devoid of technical significance as the appellant-proprietor has suggested. D1 explains (column 3, lines 24 to 29) that the hub ramp is so formed to ascend along the imaginary boundary between [turbulent] stagnant flow and [laminar] mixed flow on the pressure side of the fan. Thus, following the approach outlined above when interpreting drawings, the skilled person views the curve of the hub ramp as a technically significant teaching. Therefore, D1 discloses the hub

ramp to be curved. In this respect, it plays no role that the hub ramp is convex (cf. published patent specification, figure 2, support vanes 30), since the claim does not specify the curve's shape.

Nor does the fact that D1 describes the hub ramp as wedge shaped (cf. D1, column 2, lines 14 to 20; as indeed shown in figure 2) negate the above disclosure. The usual meaning of a wedge (see Oxford English Dictionary) is "[a] piece of wood, metal, or other hard material, thick at one end and tapering to a thin edge at the other...", thus a wedge, and its corresponding form, is not limited to an object having straight sides or a flat surface.

- 4.4 Moreover, because the hub ramp's curve traces the imaginary flow boundary the fan would have without hub ramps (see column 3, lines 24 to 29 again), the curve follows the characteristic mixed flow air path across the rear of the blade. Put differently, the hub ramp's curve corresponds to the airflow path across the rear face of each fan blade.
- 4.5 However, in the Board's view, D1 does not disclose the final (1/3rd blade length) feature. Although the hub ramp (support vane) terminates on the trailing edge 9 of the fan blade, at best it does so approximately 1/6th of the blade length from the blade root, which is different from 1/3rd. Therefore the subject matter of claim 1 differs from D1 in this respect, so D1 does not take away novelty of the claim.
- 4.6 Inventive step
- 4.6.1 The differing (1/3rd blade length) feature is taken from the detailed description of the embodiment (see

published patent specification, paragraphs [0025] to [0027] with figure 2). There it is explained that, in order not to disrupt airflow across the blade (see paragraph [0026]), the [stiffening] support vane follows the characteristic curvature of the airflow path F across the blade. When the support vane originates adjacent the blade root (as claimed) and has this characteristic curve, it intersects the trailing edge 1/3rd along the blade length. The description goes on to explain that this characteristic air flow curvature applies to mixed flow cooling fans (although this has not been claimed) and that other flow vectors will arise with other types of fans, such as radial or axial flow and that the curvature of the support vane can be modified accordingly, which suggests that the claimed value of 1/3rd along the blade length is not universal for all fan types, flows and blade curvatures. Rather, this value is closely linked to the particular choice of fan type, airflow and blade curvature or geometry.

The position of the ramp in D1 between the areas of natural stagnation and mixed flow (when the ramp is absent) necessarily results in a minimal disruption of the airflow on the blade. Otherwise, D1 is not concerned with specific shape or dimensions relative to the blade. The associated objective technical problem can thus be formulated as how to realize a ramp in a fan as in D1 of given airflow and blade curvature, or more generally how to carry out the teaching of D1.

- 4.6.2 As already explained, D1 teaches (see column 3, lines 24 to 29) to form the hub ramp so that it ascends along the imaginary boundary between [turbulent] stagnant flow and [laminar] mixed flow on the pressure side of the fan. Furthermore (see column 3, lines 34 to 37),

this ascending angle should be adapted to the operating conditions of a given fan on a case by case basis. Thus, in carrying out the teaching of D1, depending on fan operating conditions and geometry, and applying their routine design skills, the skilled person will select a particular ascending (curved) form for the hub ramp (support vane in the words of claim 1) by tracing the stagnant and mixed flow air boundary. That boundary and consequently the ramp shape and angle will vary from case to case depending on airflow and blade geometry.

In the Board's view, for certain operating conditions and blade geometries (which have not been claimed) this intersection point will inevitably lie 1/3rd of the blade length from the blade root. Thus, starting from D1 and faced with the objective technical problem of realizing its teaching, the skilled person would arrive at the subject matter of claim 1 as a matter of obviousness.

4.6.3 Therefore, the subject matter of claim 1 lacks inventive step in the light of D1 and the skilled person's general knowledge. Consequently, the second auxiliary request must fail.

5. Third auxiliary request

5.1 Added subject matter

Claim 1 is a direct combination of the subject matter of originally filed claims 1, 5, 6, 7 and 8. Therefore the Board sees no added subject matter extending beyond the application as filed and the Board considers that the claim satisfies the requirements of Article 123(2) EPC.

5.2 Novelty with respect to D1

Claim 1 adds to granted claim 1, amongst other features, a circumferential support ring attached to the hub adjacent the blade root and a vane support superstructure including an angled rib projecting substantially perpendicularly from the support vane at a middle position of said support vane.

5.2.1 The skilled person reads the terms of the claim giving them their usual meanings. The usual meaning of "ring" (see Oxford English dictionary online) is "[a] circular band of any dimension, used as a means of attachment, suspension, compression, etc." Therefore, the skilled person understands the circumferential support ring as a circular band. Nothing in the description or drawings suggests a different meaning. The description (published patent specification, paragraphs [0028] to [0032]) also uses the term "ring" and figure 2 (with detail in figure 6) shows the element 35 to be circular and continuous, that is a ring. Therefore, the Board interprets the support ring feature as meaning a circular band that supports.

5.2.2 In the Board's view, D1 (see column 3, line 42 to column 4, line 14 with figure 1) does not disclose such a circular band. Nor would the skilled person consider the entire framework between impeller axis 19 and blades 3 as a support ring.

The only ring element to be seen is the element 17, which is not adjacent the blade root as claimed but adjacent the impeller axis 19. The remaining elements constitute a framework with radial elements (e.g. elements 20), and elements concentric with the impeller

axis (e.g. 18). At best the skilled person might see this entire framework as a supporting scaffold for the hub ramps 12, but, with its many intersecting ribs (e.g. 13 and 14) and interspersed cavities (e.g. 15 and 16), it is not a circular band and therefore not a circumferential support ring as claimed.

- 5.2.3 Even if the framework has elements (for example 18) which appear to lie on the circumference of the same imaginary circle, these sections are not contiguous, but rather form ring segments. They are interrupted by radial ribs 20 and cavities 15. Therefore, they do not constitute a circular band within the normal meaning of the word, so do not form a support ring as claimed.

Therefore D1 does not disclose a circumferential support ring as claimed.

- 5.2.4 D1 also does not disclose an angled rib projecting substantially perpendicularly from a middle position of the support vane. The only ribs supporting the hub ramp 12 (support vane) are those referenced 13 and 14. Whilst they may be substantially perpendicular to the hub ramp, they are not in the middle. The rib 13 is at the very (trailing edge) end of the hub ramp, and the rib 14 is displaced from the centre of the hub ramp towards the same end.

- 5.2.5 Thus the subject matter of claim 1 differs from D1 at least in respect of these two features (circumferential support ring and angled rib). Therefore, D1 does not take away novelty of claim 1, Article 54 EPC.

- 5.3 Inventive step

- 5.3.1 According to the patent (see specification, paragraph [0031]), the angled rib 47 (which connects the support vane to the support ring) directly counteracts the aerodynamic force exerted on the support vane 30 at its mid-chord position. The objective technical problem can be seen as modifying the cooling fan of D1 so that it better counters aerodynamic forces acting on the support vane (hub ramp in the terminology of D1).
- 5.3.2 In the Board's view, nothing in D1 itself suggests how the skilled person would solve this problem. D1 explains (column 4, lines 6 to 14) that the framework supporting the hub ramp allows a one part construction of the cooling fan, but does not mention how the hub could be better supported, let alone suggests a support ring and an angled rib projecting substantially perpendicularly from the hub ramp (support vane) at a middle position thereof.
- 5.3.3 Nor, in view of the objective technical problem, does the Board think that the skilled person would modify the cooling fan of D1 to provide these features, as a matter of obviousness. In the Board's view, changing the framework under the hub ramp to include, amongst other features, a circumferential ring and an angled rib as claimed would entail completely redesigning the framework of D1 that supports the hub ramp. In the Board's view, this would require more than the skilled person's routine skills. Therefore D1 and the skilled person's general knowledge do not take away inventive step of claim 1, Article 56 EPC.
- 5.4 No further objections were raised or are apparent against the claims according to the third auxiliary request.

6. Taking into account the amendments made to the patent according to the respondent-proprietor's third auxiliary request, including amendments made to the description during the oral proceedings of 10 January 2019, the Board finds that the patent and the invention to which it relates meet the requirements of the European Patent Convention, Article 101(3) a) EPC. Therefore the patent can be maintained according to the third auxiliary request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to maintain European patent No. 1208303 in amended form, on the basis of the following documents:

Claims:

Claims 1-7 of the third auxiliary request, filed with letter of 19 December 2014

Description:

Pages 2 and 3 as filed on 10 January 2019, during oral proceedings before the Board,
Pages 4-6 of the published patent specification

Drawings:

Figures 1-10c of the published patent specification.

The Registrar:

The Chairman:



G. Magouliotis

A. de Vries

Decision electronically authenticated