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**Datasheet for the decision
of 7 July 2010**

Case Number: T 1257/08 - 3.2.04

Application Number: 99116423.7

Publication Number: 0982502

IPC: F04D 29/16

Language of the proceedings: EN

Title of invention:
Centrifugal compressor

Patentee:
Ishikawajima-Harima Heavy Industries Co., Ltd.

Opponent:
SIEMENS AKTIENGESELLSCHAFT

Headword:

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Relevant legal provisions:

EPC Art. 52(1), 56
EPC R. 140

Relevant legal provisions (EPC 1973):

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Keyword:

"Correction of decision by re-issue (no)"
"Inventive step (no)"

Decisions cited:

T 0830/03, T 0116/90

Catchword:

-



Case Number: T 1257/08 - 3.2.04

D E C I S I O N
of the Technical Board of Appeal 3.2.04
of 7 July 2010

Appellant:
(Opponent)

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Respondent:
(Patent Proprietor)

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Decision under appeal:

Interlocutory decision of the Opposition
Division of the European Patent Office posted
10 July 2008 concerning maintenance of European
patent No. 0982502 in amended form.

Composition of the Board:

Chairman: M. Ceyte
Members: A. de Vries
T. Bokor

Summary of Facts and Submissions

I. The Appellant (Opponent) lodged an appeal, received 25 June 2008, against a decision of the Opposition Division posted 7 May 2008 which on its cover sheet states that the opposition against European patent 982502 is rejected. He simultaneously paid the appeal fee and submitted the statement of the grounds of appeal.

With letter dated 10 July 2008 the European Patent Office issued a second decision, this time identified on the cover sheet as an interlocutory decision to maintain the above patent in amended form. The cover sheet is further headed, in handwriting, "correction" and states "please ignore our decision rejecting the opposition (Art. 101(2) EPC) dated 7.5.08". The annexed reasons for the decision are identical to those notified previously.

The Appellant in response with letter received 18 August 2008 submitted a "corrected" notice of appeal against the second decision.

II. The opposition had been filed against the patent as a whole based on Article 100(a) in combination with Articles 54 and 56 EPC for lack of novelty and inventive step, and on Article 100(b) EPC for insufficient disclosure.

The Opposition Division held (in the reasons to both decisions) that the grounds mentioned did not prejudice the maintenance of the patent as amended having regard in particular to the following documents:

D1: EP-B-0 799 367
D5: CH-A-695 869
D18: B.Eckert e.a.: "Axial- und Radialkompressoren",
Springer-Verlag, Berlin 1961, pp.356 - 358
D19: JP-A-6257454.

III. With a communication under Rule 100(2) EPC dated
14 July 2009 the Board made preliminary observations
inter alia concerning inventive step.

IV. The Appellant (Opponent) requests that the decision
under appeal be set aside and the patent be revoked in
its entirety.

The Respondent (Proprietor) requests that the appeal be
dismissed.

Neither party has requested oral proceedings.

V. The wording of amended claim 1 as held allowable by the
Opposition Division is as follows:

"A centrifugal compressor (1) including:
a single rotating shaft (5)
a first upstream impeller (2) and a second downstream
impeller (3) mounted on ends of the rotating shaft (5)
respectively;
an air path (35) for introducing an air accelerated by
the upstream impeller (2) to the downstream impeller
(3); and
a casing (4) for accommodating the upstream impeller (2)
and the downstream impeller (3), and for rotatably

supporting the rotating shaft (5), characterized in that an abradable layer is not provided for the upstream impeller (2), an abradable layer (34) is provided only for the downstream impeller (3), and the abradable layer (34) is embedded in the casing (4) such that it faces the downstream impeller (3) and is cuttable by the downstream impeller (3) rotating in the casing (4)."

VI. Regarding inventive step the Appellant argued as follows:

D5 does not disclose the characterizing features of claim 1. These features address the problem of reducing the cost [of applying an abradable layer to improve efficiency] without an appreciable loss in efficiency, see specification paragraph [0002]. D1 already teaches that an abradable layer can be left out at certain locations without appreciable loss. From his common general knowledge the skilled person further knows where the layer can be left out without significant losses. D18, for example, teaches him that losses are proportional to relative gap width and area. Accordingly, the layer can be left out at the first rather than the second compressor stage.

Applying the teaching of D1 and this common general knowledge the skilled person arrives at the subject-matter of claim 1 without inventive activity.

VII. The Respondent argued as follows:

D5 does not disclose the use of an abradable layer nor address the underlying problem, while D1 does not mention the claimed solution. It teaches partial reduction of the abradable layer at the compressor side of a turbine with single stage centrifugal compressor, not its complete deletion.

D1 (and D19) might inspire the skilled person to provide both stages of a two-stage centrifugal compressor as in D5 with abradable layers to improve efficiency. D1 may also inspire him to reduce the layer as far as possible to reduce costs. Neither suggest leaving the upstream layer out entirely.

D18 on the other hand does not mention compressor component wear or the use of abradable layers.

None of these documents motivates the skilled person to think about the trade-off to be made between efficiency and cost by providing only an abradable layer only at the downstream impeller of a two-stage compressor. This is possible only after realizing the problems and advantages indicated in column 2, lines 33 to 55 of the patent specification.

Reasons for the Decision

1. *Admissibility of the Appeal*

The first written decision posted 7 May 2008 was duly notified in accordance with Rules 111 and 113 EPC. Under the presumption of legal validity, it constitutes the opposition division's only legally valid written decision, cf. T0830/03, reasons 1.1 and 1.2. The opposition division is bound by it and cannot itself set it aside. The subsequent second written decision posted 10 July 2008 with instruction to disregard the first therefore has no legal effect. In so far as it is headed "correction" it attempts to correct an obvious inconsistency between the first written decision's tenor as stated on its cover page and that expressed in the reasons and minutes accompanying it. At best therefore the notification of 10 July 2008 can be regarded as a correction (albeit in formally incorrect form) to the first decision of an obvious mistake, Rule 140 EPC, with retrospective effect, see T116/90. As it is legally void as a decision, the second notice of appeal filed against it also has no effect. The Board adds that a procedurally proper correction of the first decision is moot in view of the present decision.

Only the first written decision as legally valid decision is appealable, and admissibility is decided in relation to that decision. In the present case the first notice of appeal and the statement of grounds of appeal were filed and the appeal fee paid within the statutory time periods prescribed therefor by Article 108 EPC and Rule 126(2) EPC and starting from the date of posting of the first written decision. As

all other formal requirements are indisputably met, the Board concludes that the appeal is admissible.

2. *Background*

The patent concerns the use in a compressor of an abradable layer on the casing facing the impeller. The impeller effectively machines the layer to produce optimal clearance and so improve efficiency, see specification paragraph [0002]. The main idea of the invention is to apply such a layer in a multi-stage compressor, but only where it matters most, namely in the downstream stage. Efficiency can thus be improved at comparably low cost, see specification paragraphs [0006] and [0008].

3. *Inventive Step*

3.1 It is common ground that, for inventive step at least, D5 discloses the closest prior art. Figure 3 for example shows a typical two stage centrifugal compressor with upstream and downstream impellers 28a and 28b on opposite ends of a rotating shaft 3 and connected by an air path 17 all housed within a casing visible in figure 2.

3.2 Equally undisputed is the fact that the compressor of claim 1 in the form held allowable by the opposition division differs from this prior art in the claim's characterizing features. The D5 compressor has no abradable layers in the casing opposite either impeller and cuttable by it as it rotates, much less such an abradable layer provided only at the downstream but not the upstream impeller. The Board reads "cuttable" in

context to mean that the abradable layer is arranged in the casing and has relative physical qualities so that in operation it is cut or abraded by the rotating impeller.

- 3.3 An abradable layer at the downstream impeller has a greater effect on performance or efficiency than at the upstream impeller. Efficiency can thus be significantly improved at a comparably low cost, see specification paragraph [0008]. This represents a favourable trade-off between cost and efficiency when trying to improve efficiency in a two-stage centrifugal compressor at low cost. The technical problem can be formulated accordingly as *how to improve the efficiency of a two-stage centrifugal compressor such as that of D5 at minimal cost.*

Improving efficiency/performance of a two-stage compressor is standard aim of the skilled person, a mechanical engineer involved in the design and manufacture of compressors. He will be equally familiar with cost as a constraint on development efforts. Intent on improving efficiency but faced with a limited budget he will therefore strive to balance the two and find the best trade-off. This part of his normal remit and the formulation of this problem itself does not require any ingenuity on his part. He thus needs no explicit prompt from the prior art in this regard. In any case D1 already expressly recognizes the need to make trade-offs between efficiency and cost, see paragraph [0018] for example, though it may offer a different solution.

3.4 As acknowledged in the patent, see paragraph [0002] discussing D19, the use of abradable layers in compressors in the casing opposite the impeller to improve (compression) efficiency is known per se. D1 provides another example. In either case, an abradable layer facing the impeller of the compressor stage of a turbo-charger is seen to improve performance of the compressor, see abstract in D19 and paragraph [0035] in D1.

That this known measure for improving efficiency in a single stage centrifugal compressor can apply also to a *two-stage* compressor also does not require any inventive insight on the part of the skilled person. Nor does this appear to be disputed by the parties. The Board also subscribes to this view.

3.5 Applying the teaching of D1 or D19 to a compressor in D5 is thus obvious per se. An inventive step must therefore hinge on the question as to *how* that teaching is applied. More precisely, see also the Board's communication of 14 July 2009, where D1 or D19 show application to a single compressor stage, would the skilled person as a matter of obviousness apply that teaching to *only one of the two stages* in a D5 type compressor to reduce cost while accepting lower efficiency for the other stage? If yes, does the insight that one of the two available options has better overall efficiency, because it is more sensitive to downstream clearance, make the specific choice of that option not obvious?

3.6 The first part of this question the Board indeed answers in the affirmative. In its view the skilled person will as a matter of obviousness apply the teaching of D1 or D19 to only one of the two stages of a D5 type compressor to improve efficiency at reduced cost.

As remarked earlier that problem is itself is a routine one. The simplest, most obvious way of cutting costs in applying some measure is to reduce the number of instances the measure is applied. In this case this naturally means applying a layer as in D1 or D19 to only one of the two stages of a compressor as in D5. D1 potentially offers the best trade-off, as it already offers savings in the particular way the layer is applied to a stage, and is therefore the more interesting for somebody on a tight budget. However, in either case obvious savings can be made.

3.7 As for the second part of the above question, the Board does not believe that the insight that and why one of the two options for applying the layer gives a better overall efficiency than the other, makes the specific choice of that option inventive.

3.7.1 The Board recalls that the invention's aim is an optimal trade-off between efficiency and cost, per se obvious as noted above. It stands to reason that if the skilled person can make an obvious saving by applying the layer to only one the two stages he will as a matter of course want to choose that one which offers him the best trade-off, i.e. the one that gives him the higher efficiency. To that end he will carry out routine tests to determine which of the two has the

higher efficiency and establish that it is the compressor with a layer at only the downstream stage. Alternatively, he can make an informed choice using his common general knowledge, as illustrated by D18. D18 teaches that efficiency losses are proportional to the relative gap width and area. Losses are thus higher downstream than upstream where the relative gap width and area are smaller. By leaving out the upstream layer efficiency losses are lower and overall efficiency is higher than if the downstream layer is left out.

3.7.2 In any case, there are only a very limited number of options, two in this case. At least on first consideration these will appear equally feasible to the skilled person; there is nothing in the prior art or common knowledge which might dissuade him from considering any particular one of these. Consequently, they are a priori equivalent options. Whichever choice he makes it will then be without inventive merit.

3.8 In summary, the skilled person as a matter of course will apply the teachings of either D1 or D19 to a centrifugal compressor as in D5 to improve efficiency. If he must cut costs doing so, he will make obvious savings by applying the teaching to only one of its two stages. As he is obviously interested in the best trade-off between efficiency and cost, he will in routine manner choose that stage that gives the best overall efficiency, the downstream stage, thus arriving at the subject-matter of claim 1 as held allowable by the opposition division without exercising inventive skill. The Board concludes that the subject-matter of claim 1 does not involve an inventive step, so that the

patent as amended fails to meet the requirements of Article 52(1) and 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar

The Chairman

G. Magouliotis

M. Ceyte