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**Datasheet for the decision
of 19 February 2013**

Case Number: T 1189/10 - 3.2.04

Application Number: 01830178.8

Publication Number: 1249613

IPC: F04D 19/04

Language of the proceedings: EN

Title of invention:

Turbine pump with a stator stage integrated with a spacer ring

Patent Proprietor:

Agilent Technologies, Inc.

Opponent:

Pfeiffer Vacuum GmbH

Headword:

-

Relevant legal provisions:

EPC Art. 100(a), 123(2)

Keyword:

"Main request - inventive step (no)"

"Auxiliary requests - unallowable added subject-matter (yes)"

Decisions cited:

T 1067/97, T 0714/00

Catchword:

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Case Number: T 1189/10 - 3.2.04

D E C I S I O N
of the Technical Board of Appeal 3.2.04
of 19 February 2013

Appellant: Pfeiffer Vacuum GmbH
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 7 April 2010 rejecting the opposition filed against European patent No. 1249613 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman: A. de Vries
Members: C. Scheibling
T. Bokor
J. Wright
C. Heath

Summary of Facts and Submissions

- I. By its decision dated 7 April 2010 the Opposition Division rejected the opposition. On 28 May 2010 the Appellant (opponent) filed an appeal and paid the appeal fee simultaneously. The statement setting out the grounds of appeal was received on 8 July 2010.
- II. The patent was opposed on the grounds based on Article 100(a) EPC (lack of novelty and inventive step).
- III. The following documents played a role in the appeal proceedings
- E3: WO-A-99/60275
E4: DE-A-2 046 693
E6: US-A-5 585 548
- IV. Oral proceedings took place on 19 February 2013 before the Board of Appeal.
- V. The Appellant requests that the decision under appeal be set aside and that the patent be revoked.

The Respondent requests that the appeal be dismissed (main request), or in the alternative, that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of any of the auxiliary requests 1 to 3 filed by letter dated 8 January 2010 or of auxiliary request 4 filed with letter dated 21 January 2013.

VI. Claims 1 of the requests reads as follows

Claim 1 of the main request (as granted)

"Turbine pump with a transition chamber (9) at an intermediate pressure separating a low-pressure section (1B) from a high-pressure section (1A) and with an additional inlet (5) opening into said chamber (9), said sections comprising multiple rotor stages (6) carried by a shaft (7) and multiple stator stages (8, 10) comprising each a bladed disc (11) surrounding the rotor shaft (7), said transition chamber (9) being defined on one side by a stator stage (10), characterised in that at least the stator stage (10) defining said transition chamber (9) has radial blades (17) that are arranged at an acute angle relative to the surface of the disc (11) such that adjacent blades (17) overlap so as to make the stage optically opaque in axial direction, and are separated by separation channels (18) that pass through the whole thickness of the disc (11)".

Claim 1 of auxiliary request 1 adds to claim 1 as granted "and in that said stator stage (10) has a side wall (12), integral with said disc (11) and acting as a spacer ring".

Claim 1 of auxiliary request 2 adds to claim 1 as granted "and in that said stator stage (10) has a side wall (12), integral with said disc (11) and acting as a spacer ring, said side wall (12) having a high-conductance opening (13) formed therein, which communicates with intermediate inlet (5)".

Claim 1 of auxiliary request 3 adds to claim 1 as granted "and in that said stator stage (10) is divided into two halves (10', 10'') along a diametrical line, to allow mounting the stage (10) about rotor shaft (7) and has a side wall (12), integral with said disc (11) and acting as a spacer ring (12) axially projecting from said disc (11) in opposite directions and to different extents in both directions, and having, in a portion (12A) projecting to a greater extent, a high-conductance opening (13) communicating with said additional inlet (5) and in a portion (12B) projecting to a lesser extent, an annular groove (14) housing a resilient ring (15) arranged to keep the two halves (10', 10'') of the stator stage (10) in contact".

Claim 1 of auxiliary request 4 corresponds to claim 1 of auxiliary request 3 where the expression "in that said stator stage (10) is divided into two halves (10', 10'') along a diametrical line" has been modified to read "in that said stator stage (10) is divided into two identical portions (10', 10'') along a diametrical line".

VII. The Appellant mainly argued as follows:

E3 relates to a turbine pump with a transition chamber which discloses the feature of the preamble of claim 1 as granted. This citation mentions that the first pumping stage should produce a high compression ratio and that the configuration of the blades of the stator and rotor discs must be specially adapted to achieve this result. The turbo pump of E6, figure 3, has a similar configuration.

E4 teaches the skilled person that in order to increase the compression ratio of a turbo-molecular pump the stator and rotor stages should be provided with blades that overlap more the nearer they are to the outlet, the blades of the final rotor and stator stages overlapping by half the width of a blade. Thus, when applying the teaching of E4 to the turbine pump of E3 or E6, the skilled person would arrive at the turbine pump of claim 1.

Claim 1 of all auxiliary requests comprises features taken in isolation from a set of features which has originally been disclosed in combination in the description. Therefore, the requirements of Article 123(2) EPC are not met.

The Respondent submitted in essence that

E3 and E6 both disclose a split flow turbine pump as in the patent comprising an inlet, a first pump stage, an intermediate inlet, a second pump stage and an outlet. E4 discloses a turbine pump comprising an inlet a single pumping stage and an outlet. Thus the two types of pumps are so different that a skilled person would not refer to E4 in order to improve a pump according to E3 or E6. Furthermore, although the blades of the final rotor and stator stage are said to be overlapping there are possible configurations within the indicated ranges with which no complete overlap is obtained. Thus, there is no clear teaching to provide such an overlap so as to make the stage optically opaque. Moreover, E4 teaches to provide the final rotor and stator stages with overlapping blades. When applying this teaching to the pump of E3 this would imply that the overlapping rotor

and stator stages should be the stages nearest the outlet of the pump and not the stages adjacent to the transition chamber.

Claim 1 of the auxiliary requests comprises features which have been taken from the description. However, the invention refers to several objects which are achieved by different features, so that not all features are essential with respect to each aspect of the disclosure. Furthermore, some features specifically referred to in the description are obviously implicit, so that it was not necessary to specify them in detail.

Reasons for the Decision

1. The appeal is admissible.
2. *Inventive step - main request*
 - 2.1 E3 and E6 are considered to be the most promising springboards for the present invention. It is undisputed that each of these documents discloses a turbine pump with a transition chamber at an intermediate pressure separating a low-pressure section from a high-pressure section according to the preamble of claim 1.

The Board considers that E3 is the closest prior art, because it mentions in addition that the first pumping stage shall provide a high compression ratio and that the configuration of the blades of the stator and rotor discs must be specially adapted to achieve this result (see page 3, lines 1 to 7 of the second paragraph). The pump is shown in detail in figure 1, see also page 4,

3rd paragraph, to page 5, first paragraph. This two stage pump with stator discs 22 and rotor discs 21 has a transition chamber with inlet 37 separating the upper low pressure stage (with inlet at 36) from the lower high pressure stage (with outlet at 17). Both stator and rotor discs are formed of radial blades ("Schaufelreihen") implying that the spaces between blades form channels that pass through the whole thickness of the disc.

2.2 The turbine pump of claim 1 differs from that disclosed in E3 in that at least the stator stage defining said transition chamber has radial blades that are arranged at an acute angle relative to the surface of the disc such that adjacent blades overlap so as to make the stage optically opaque in axial direction.

2.3 The acute blade angle and overlap result in very narrow channels between the blades of the stator and produce a higher compression ratio at the stator stage so that the pump can tolerate a high pressure in the transition chamber, see patent specification, paragraph [0018].

The problem underlying the invention with respect to E3 as closest prior art can be formulated accordingly as increasing the maximal pressure that can be obtained at the transition chamber, as stated in the patent specification, paragraph [0010].

2.4 E3 (see page 3, lines 1 to 7 of the first paragraph) already makes clear that the configuration of the blades is critical for obtaining a high compression ratio.

2.5 E4 is concerned with improving the performance of turbine pumps, particularly as regards its pressure regime, focussing mainly on the construction of the stator and rotor blades, see page 2, last two paragraphs continuing onto page 3. The construction is illustrated for a turbo-pump as shown in figure 1 which a common inlet 34 feeding symmetrically arranged left and right compressor units 72 and 74 (page 5, penultimate paragraph, page 6, last paragraph continued onto page 7) that are otherwise identical. Different groups of rotor-stator pairs have different constructions. Those nearer the main inlet are constructed as shown in figures 2 to 9 (page 8, lines 19 to 21 and page 10, lines 11 and 12), those in a middle group as in figures 10 and 11 (page 11, first and last complete paragraphs) and those nearer the outlet as in figures 12 to 15 (page 12, lines 3 to 5). Though figures 12 to 15 are described as relating to rotor elements, stators and rotors are here also mirrored, page 13, first paragraph.

On page 18, penultimate paragraph to page 19, second paragraph, E4 discusses various parameters involved such as blade angle "a", ratio of blade spacing "s" and blade width "b", as well as amount of overlap. All angles mentioned there can be said to be acute. Page 18, complete final sentence, states that the middle group blade angle is between 15 and 30° and that there should be some but not too much overlap, as indeed shown in figures 11 and 12. In the final group, nearest the outlet, the angle should be between 5 and 20°, preferably 10°, and the degree of overlap should even be higher, for example half the blade depth, page 19, first complete paragraph, final sentence. The overlap in figures 11 to 15 is such that light cannot pass through

the disk directly or in parallel to the axial direction, so that viewed in that direction, from the front or back of the disc, it is optically opaque.

E4 teaches that this construction achieves a greater pressure increase across the whole pump as well as across individual (rotor/stator) stages, page 19, final paragraph. On page 13, second paragraph, final sentence, the increase in pressure per stage is associated in particular with overlapping blade arrangement of figure 12 nearer the outlet. This is contrasted with higher volumes possible with open blade structure nearer the inlet.

The skilled person thus learns from these passages in E4 that in order to improve the pressure increase across a pump, i.e. to improve its compression ratio, he should arrange and construct the rotor-stator pairs as shown in figures 2 to 15, that is with increasing acute angles and increasing overlap nearer the pump outlet.

- 2.6 The skilled person confronted with the problem of maximising the pressure increase obtainable in the transition chamber of a pump such as that of E3 will look toward E4. He is in particular prompted to do so by the express statement in E3 itself, on page 3, second complete paragraph, that a high compression ratio (the ration between output and input pressure) in the first low pressure stage of the pump is achieved by the properties of the blades, such as spacing and blade angle. E4 provides him with a specific teaching how these and other blade parameters should be set to achieve the desired compression ratio and resulting

maximum pressure at the outlet of the first low pressure stage, i.e. in the transition chamber of the pump.

Accordingly, it is obvious for the skilled person to provide the final pair of rotor and stator disks of the first pumping stage of the pump of E3 with highly overlapping blades as taught by E4 in order to improve the compression ratio of this pumping stage.

- 2.7 The Respondent submitted that the skilled person would not take E4 into consideration because it relates to a different type of turbine pump as E3.

However, as stated in E4, on page 5, three last lines of the penultimate paragraph and as it is clear from the whole of the description of E4, the teaching provided by this citation is not limited to any particular type of turbine pump having a given number of pumping units, but applicable to individual turbine pumping units irrespective of the number of units that constitute the whole pump.

The Respondent further argued that although the blades of the final rotor and stator stage are said to be overlapping, specific combinations of borderline values of the ranges indicated on page 19 in the first complete paragraph, can result in configurations that do not exhibit complete overlap of the blades. Therefore E4 does not provide a clear teaching to arrange the blades such that they overlap so as to make the stage optically opaque.

However, E4 clearly states that the last rotor/stator stage should have blades which overlap half the width of

a blade and which are most preferably arranged at an angle of 10° relative to the surface of the disc (first complete paragraph of page 19). Thus, even if there might be specific combinations of borderline values taken within the indicated ranges that might result in an arrangement of blades which do not overlap, the skilled reader would disregard these isolated examples as not being part of the general teaching of E4.

Finally, the Respondent submitted that even if the skilled person would try to apply the teaching of E4 to the turbine pump of E3, he would not arrive at the invention, because E4 teaches to locate the rotor/stator stage with overlapping blades next to the final outlet of the pump and not next to the transition chamber as claimed.

However, it is clear for the skilled person that the turbine pump of E3 (see figure 1) comprises three different stages or units, two turbo-molecular stages or units 12 and 13 and one molecular (Holweck) pump 14. Each unit (12, 13 and 14) produces a different degree of vacuum pressure. The first turbine pumping unit 12 is designed to obtain a high compression ratio and the second turbine pumping unit 13 is designed to provide a high volume flow rate (see page 6, second paragraph). Therefore each of these units can be considered as a separate pump.

This point of view is further confirmed by figure 1 of E6 that shows that although the rotors of the pumping units 5 and 6 are driven by a common shaft 21 (figure 3), each unit is represented in fact as a pump per se.

Moreover, the passage on page 13, lines 18 to 23 of the second paragraph of E4 clearly teaches that discs with "open" blades result in a higher volume flow rate whereas discs with blades according to figure 12 (that are overlapping) result in a higher compression ratio.

Therefore, the skilled person, who in the present case is a mechanical engineer working in the field of turbine vacuum pumps, would obviously apply the teaching of E4 aiming at obtaining a higher compression ratio (overlapping blades) to the first turbine pumping unit 12 of E3 and the teaching aiming at obtaining a higher volume flow rate (open blades) to the second turbine pumping unit 13 of E3.

2.8 Consequently, the subject-matter of claim 1 of the main request does not involve an inventive step.

3. *Auxiliary requests 1 to 4*

3.1 Claim 1 of each of the auxiliary requests has been modified by adding features taken from the description.

3.2 The Respondent has submitted that the added features are disclosed in the paragraphs [0011] and [0012] and the figures of the application as published.

3.3 According to the established case law of the Boards of Appeal, it is normally not admissible to extract an isolated feature from a set of features that have originally been disclosed in combination and to add it to the claimed subject-matter, if there is a structural or functional relationship between those features; see in particular T 1067/97 and T 714/00.

- 3.4 In paragraphs [0011] and [0012] the disc of the stator stage with an integral side wall is said to be a cup like member. The fact that the stator stage has such a cup like shape implies for the disc to be at least positioned nearer to one end of the side wall than to the other. This feature thus implies structural limitations to the stator stage.

Consequently, adding to the claimed subject-matter that the stator stage comprises a side wall without specifying that it has a cup-like shape positioned in particular orientation in the pump, amounts to extracting isolated features from a group of features which were originally disclosed in combination and between which there is a structural relationship. This objection concerns all auxiliary requests.

- 3.5 Furthermore, in auxiliary requests 3 and 4, it is stated that the side wall is "axially projecting from said disc (11) in opposite directions and to different extents in both directions, and having, in a portion (12A) projecting to a greater extent [sic], a high-conductance opening (13) communicating with said additional inlet (5) and in a portion (12B) projecting to a lesser extent [sic]". However paragraph [0012] further specifies that the "portion 12A that, when the stator is mounted, is located on the side of high pressure pump section 1A, is higher than the other portion and has a high-conductance opening 13 formed therein, which communicates with intermediate inlet 5". This statement indicates how the stator disc and the side wall portions are positioned with respect to the two pumping stages. The fact that the stator stage and the side wall portions are mounted

this way and not upside down is critical for the result (increasing the compression ratio) to be obtained. There is thus a functional relationship between the features which indicate how to mount the stator disc and the fact that the side wall of the stator projects axially from said disc in opposite directions to different extents.

Consequently, adding to the claimed subject-matter that the side wall of the stator projects axially from said disc in opposite directions and to different extents without specifying how the higher and lower portions of the side wall are positioned with respect to the pumping stages and without specifying the high conductance opening and its position, amounts to extracting isolated features from a group of features which were originally disclosed in combination and between which there is a functional relationship.

- 3.6 The Respondent argued that the omitted features are either implicit or not essential for the objects to be achieved.

This point of view cannot be shared. Having a side wall integral with the disc does not necessarily imply a cup like shape. For example if the side wall projects from the disc in opposite directions to a same extent, the shape of the stator stage would definitely not be cup-like. Thus, having a side wall integral with the disc does not implicitly mean that it has a cup-like shape, much less a particular orientation of such a cup like disc.

According to the Respondent the problem to be solved by the invention is to increase the maximal pressure that

can be obtained at the transition chamber. According to the patent specification this is obtained by having the final stator stage of the low pressure section 1B provided with overlapping blades so as to make it opaque.

It is thus necessary that this stator stage be located upstream of the intermediate inlet. This is only the case if it is specified how the higher and lower portions of the side wall and thus the stator disc are positioned with respect to the pumping stages. This feature is therefore necessary for solving the problem underlying the invention.

Since no other indication is given in claim 1 from which it could be derived whether the stator disc should be nearer to the high-pressure section 1A or to the low-pressure section 1B, this information cannot be derived in an implicit manner either.

3.7 Accordingly, claim 1 of all auxiliary requests as amended contravenes the requirements of Article 123(2) EPC. Consequently, the auxiliary requests must fail.

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:

M. Cañueto Carbajo

A. de Vries