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**Datasheet for the decision  
of 25 September 2007**

**Case Number:** T 1252/05 - 3.2.04

**Application Number:** 97935906.4

**Publication Number:** 0916023

**IPC:** F03B 3/02

**Language of the proceedings:** EN

**Title of invention:**

Runner for Francis-type hydraulic turbine

**Patentee:**

GE Energy (Norway) AS

**Opponent:**

VA TECH HYDRO GmbH & Co.

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 100(a), 113(1), 114

**Keyword:**

"Abuse of procedure (no)"

"Novelty (yes)"

"Inventive step (no)"

"Automatic remittal after citation of a new document (no)"

**Decisions cited:**

T 0402/01

**Catchword:**

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Case Number: T 1252/05 - 3.2.04

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.04  
of 25 September 2007

**Appellant:** VA TECH HYDRO GmbH & Co.  
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**Respondent:** GE Energy (Norway) AS  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 26 July 2005  
rejecting the opposition filed against European  
Patent No. 0916023 pursuant to  
Article 102(2) EPC.

**Composition of the Board:**

**Chairman:** M. Ceyte  
**Members:** C. Scheibling  
T. Bokor

## Summary of Facts and Submissions

I. By its decision dated 26 July 2005 the Opposition Division rejected the opposition. On 26 September 2005, the Appellant (opponent) filed an appeal and paid the appeal fee simultaneously. The statement setting out the grounds of appeal was received on 5 December 2005.

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 present proceedings:

A1: The International Journal on Hydropower & Dams; ISSN 1352-2523; volume Three; Issue Three; 1996; pages 38 to 42; "Hydraulic design strategy for Francis turbines", H. Brekke.

A6: "Turbomachines hydrauliques", Pierre Henry, 1992

A7: "Waterpower' 95, Proceedings of the International Conference on Hydropower", Edited by John j. Cassidy; Volume 1; pages 739 to 747; "Model Development of the Francis Turbines for the LiJiaXia Project in China"; Brigitte Boyer at al.

IV. Claim 1 according to the main request (as granted) reads as follows:

"1. Runner for Francis-type hydraulic turbine, comprising a ring (1), a hub (2) and a number of blades (3) having a curved shape and being attached to the

ring and the hub, where each blade (3) has an inlet edge (5) adapted to face towards an upstream guide apparatus in the turbine and an outlet edge (6) adapted to face towards a downstream draft tube (9) from the turbine, wherein a junction or attachment point (A) of the blade inlet edge (5) at the ring (1) is located forwardly of the inlet edge junction or attachment point (C) at the hub, and wherein the attachment point (B) of the blade outlet edge (6) at the ring (1), is located forwardly of the outlet edge attachment point (D) at the hub (2), as seen in the rotational direction (R) of the runner."

Claim 1 according to the first auxiliary request reads as follows:

"1. Runner for Francis-type hydraulic turbine, comprising a ring (1), a hub (2) and a number of blades (3) having a curved shape and being attached to the ring and the hub, where each blade (3) has an inlet edge (5) adapted to face towards an upstream guide apparatus in the turbine and an outlet edge (6) adapted to face towards a downstream draft tube (9) from the turbine, wherein a junction or attachment point (A) of the blade inlet edge (5) at the ring (1) is located forwardly of the inlet edge junction or attachment point (C) at the hub, and wherein the attachment point (B) of the blade outlet edge (6) at the ring (1), is located forwardly of the outlet edge attachment point (D) at the hub (2), as seen in the rotational direction (R) of the runner, wherein the angular extension ( $\emptyset a$ ) of the outlet edge (6) taking the rotational direction into account, is larger than the corresponding angular extension ( $\emptyset i$ ) of the inlet edge (5)."

Claim 1 according to the second auxiliary request reads as follows:

"1. Runner for Francis-type hydraulic turbine, comprising a ring (1), a hub (2) and a number of blades (3) having a curved shape and being attached to the ring and the hub, where each blade (3) has an inlet edge (5) adapted to face towards an upstream guide apparatus in the turbine and an outlet edge (6) adapted to face towards a downstream draft tube (9) from the turbine, wherein a junction or attachment point (A) of the blade inlet edge (5) at the ring (1) is located forwardly of the inlet edge junction or attachment point (C) at the hub, and wherein the attachment point (B) of the blade outlet edge (6) at the ring (1), is located forwardly of the outlet edge attachment point (D) at the hub (2), as seen in the rotational direction (R) of the runner, wherein the angular extension ( $\emptyset a$ ) of the outlet edge (6) taking the rotational direction into account, is larger than the corresponding angular extension ( $\emptyset i$ ) of the inlet edge (5), and at and at least equal to  $15^\circ$ ."

Claim 1 according to the third auxiliary request reads as follows:

"1. Runner for Francis-type hydraulic turbine, comprising a ring (1), a hub (2) and a number of blades (3) having a curved shape and being attached to the ring and the hub, where each blade (3) has an inlet edge (5) adapted to face towards an upstream guide apparatus in the turbine and an outlet edge (6) adapted to face towards a downstream draft tube (9) from the

turbine, wherein a junction or attachment point (A) of the blade inlet edge (5) at the ring (1) is located forwardly of the inlet edge junction or attachment point (C) at the hub, and wherein the attachment point (B) of the blade outlet edge (6) at the ring (1), is located forwardly of the outlet edge attachment point (D) at the hub (2), as seen in the rotational direction (R) of the runner, wherein the ratio between the diameters (Dd and Db) at the attachment points of the outlet edge at the hub (2) and the ring (1), respectively, is between 0,3 and 0,4."

Claim 1 according to the sixth auxiliary request reads as follows:

"1. Runner for Francis-type hydraulic turbine, comprising a ring (1), a hub (2) and a number of blades (3) having a curved shape and being attached to the ring and the hub, where each blade (3) has an inlet edge (5) adapted to face towards an upstream guide apparatus in the turbine and an outlet edge (6) adapted to face towards a downstream draft tube (9) from the turbine, wherein a junction or attachment point (A) of the blade inlet edge (5) at the ring (1) is located forwardly of the inlet edge junction or attachment point (C) at the hub, and wherein the attachment point (B) of the blade outlet edge (6) at the ring (1), is located forwardly of the outlet edge attachment point (D) at the hub (2), as seen in the rotational direction (R) of the runner, wherein the angular extension ( $\emptyset a$ ) of the outlet edge (6) taking the rotational direction into account, is larger than the corresponding angular extension ( $\emptyset i$ ) of the inlet edge (5), and wherein the ratio between the diameters (Dd and Db) at the

attachment points of the outlet edge at the hub (2) and the ring (1), respectively, is between 0,3 and 0,4, and wherein the attachment point (D) of the outlet edge at the hub (2) is located lower than the middle point (15) of the blade inlet edge."

Claim 1 according to the seventh auxiliary request reads as follows:

1. Runner for Francis-type hydraulic turbine, comprising a ring (1), a hub (2) and a number of blades (3) having a curved shape and being attached to the ring and the hub, where each blade (3) has an inlet edge (5) adapted to face towards an upstream guide apparatus in the turbine and an outlet edge (6) adapted to face towards a downstream draft tube (9) from the turbine, wherein a junction or attachment point (A) of the blade inlet edge (5) at the ring (1) is located forwardly of the inlet edge junction or attachment point (C) at the hub, and wherein the attachment point (B) of the blade outlet edge (6) at the ring (1), is located forwardly of the outlet edge attachment point (D) at the hub (2), as seen in the rotational direction (R) of the runner, wherein the angular extension ( $\emptyset a$ ) of the outlet edge (6) taking the rotational direction into account, is larger than the corresponding angular extension ( $\emptyset i$ ) of the inlet edge (5), and at least equal to  $15^\circ$ , wherein the ratio between the diameters ( $D_d$  and  $D_b$ ) at the attachment points of the outlet edge at the hub (2) and the ring (1), respectively, is between 0,3 and 0,4, and wherein the attachment point (D) of the outlet edge at the hub (2) is located lower than the middle point (15) of the blade inlet edge."

V. Oral proceedings before the Board took place on 25 September 2007.

In addition to the prior art cited before the opposition division, the Appellant cited for the first time four prior uses. The Respondent held that these were inadmissible, both as late filed and as not having been public.

The Appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

He mainly argued as follows:

The subject-matter of claim 1 according to the main request lacks novelty or is at least not inventive with respect to A1.

The patent specification does not indicate any specific effect to be obtained by the additional features of the auxiliary requests. These features have been chosen at random and do not solve any particular technical problem. Furthermore, these additional features are known either from A1, A6 or from A7. Accordingly, the subject-matter of claim 1 of all auxiliary requests does not involve an inventive step either.

The Respondent (patentee) countered the Appellant's arguments and mainly argued as follows:

A1 does not disclose a runner with a blade outlet edge skewed forwardly in direction of rotation. Furthermore, A1 discloses different embodiments and there is no

indication that could lead a skilled person to combine them.

A7 should not be introduced into the proceedings, because the Appellant committed an abuse of procedure, since A7 was at his disposal but was deliberately not introduced in due time.

The additional features of the auxiliary requests all contribute to solve the problem of the invention as stated in the patent specification. It is not possible to take measurements from the schematic figures of A1 or A7, which therefore cannot disclose the features claimed in the auxiliary requests. A6 shows a collection of different turbines actually in use. Not all turbines of A6 exhibit the claimed features, but each of them has been designed for specific working conditions. Thus, there was no reason for a skilled person to take in isolation some of the features shown in A6 and to apply them to a runner which corresponds to a hypothetical runner resulting from the combination of two embodiments of A1 and which is to be run under unknown working conditions.

The Respondent requested that the appeal be dismissed and the patent be maintained as granted (main request) or that the decision under appeal be set aside and the patent be maintained on the basis of the claims according to one of the first, second, third, sixth or seventh auxiliary requests, all filed with letter dated 13 April 2006.

Auxiliary requests 4, 5, 8 and 9 have been withdrawn during the oral proceedings before the Board.

## Reasons for the Decision

1. The appeal is admissible.
2. *Main request - Novelty and Inventive step:*
  - 2.1 A1 refers to "Hydraulic design strategy for Francis turbines" and more specifically to reducing pressure pulsation, avoiding cavitation and sand erosion in the design of medium-head Francis turbines. It is undisputed that A1 refers to a runner comprising a ring, a hub and a number of blades having a curved shape and being attached to a ring and a hub, where each blade (Figures 6, 8) has an inlet edge adapted to face towards an upstream guide apparatus in the turbine and an outlet edge adapted to face towards a downstream draft tube from the turbine, wherein a junction or attachment point of the blade inlet edge at the ring is located forwardly of the inlet edge junction or attachment point at the hub (section 2, fourth paragraph; Figure 8b,  $\Delta\theta = +10^\circ$ )

Furthermore, section 1.4 discloses the influence of the blade outlet geometry on pressure oscillations in the draft tube. It is stated therein that "However, a stabilizing effect from skewed blade outlets has also been observed for runners without splitter blades". Thus, there is disclosed that skewed blades are advantageous with respect to radial outlet edges.

Since no rotational direction is indicated in Figure 6, the skew may extend in either rotational direction.

Thus, novelty of the subject-matter of claim 1 of the main request is given with respect to A1.

2.2 Since the teaching of A1 (chapter 1.4) excludes radial outlet edges, the skilled person can only select between forward and backward skewed blade outlet edges. Thus, the skilled person is only offered two possibilities. Accordingly, the choice of one rather than the other does not involve an inventive step; all the more because it is doubtful whether providing a runner having forwardly skewed blade inlet edges with backwardly skewed blade outlet edges would make technical sense.

2.3 The Respondent argued that A1 does not disclose forwardly skewed blade outlet edges for a medium head Francis turbine, because chapter 1.4 refers to high head turbines and that there is no hint in A1 that the different embodiments disclosed therein should be combined.

In its introductory part, A1 clearly indicates:  
"Reducing pressure pulsation, avoiding cavitation and sand erosion are the main objectives in the design of medium-head Francis turbines. The ideal goal is to design a runner which has the widest possible operating range for head variations beyond the normal design head, and which would require minimal maintenance. This paper gives a brief description of the use of design parameters for the hydraulic shape, followed by CFD analysis and model tests, to achieve this goal". The article further mentions "The design of a Francis turbine can be done in three main stages..."

Consequently, A1 refers to the design of a runner for a medium-head Francis turbine comprising three steps, which are performed successively to define a single optimized runner and not a series of different embodiments.

Chapter 1 is entitled "First step hydraulic design of a Francis runner". Thus, paragraph 1.4 which refers to the "Influence of the blade outlet geometry on pressure oscillations in the draft tube" relates also to this first design step (of medium head turbines). Therefore, the statement that "it has been proven by prototype tests that the introduction of ... skewed blades outlets in high head turbines have led to smoother operation in off design conditions ..." cannot lead to assumption that paragraph 1.4 relates to a different (high head) type of turbines, but simply means that skewed blades outlets are likewise advantageous for the design of medium head turbines.

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

3. *Admissibility of A7, remittal to the first instance to consider A6:*

3.1 A7 was filed two months before the oral proceedings on 9 June 2005 before the Opposition division who decided to admit it into the proceedings.

The Respondent argued that A7 was known by the Appellant since 2004 but deliberately withheld, so that its late filing amounted to an abuse of procedure.

The Respondent referred in this respect to a letter of the Opponent dated 11 April 2005 showing that the Opponent knew this citation since 17 August 2004.

However, in this letter it is also stated that A7 was filed in reaction to the patent proprietor's arguments.

The Respondent further argued that the alleged prior uses filed with the statement of the grounds of appeal were known by the Opponent before filing the opposition and that this evidence was deliberately withheld for tactical reasons. This was according to the Respondent a clear indication of the manner the Opponent behaved in these proceedings.

However, it would be not correct to prejudge the issue as to the admissibility of A7 on the fact that the alleged prior uses have also been late filed for tactical reasons.

A7 was filed and taken into consideration during opposition proceedings and the Appellant has contested that he deliberately chose not to file A7 as soon as its relevance for the case became apparent. Therefore, the Board is not convinced that the late filing of A7 was an abuse of procedure and that the Opposition division did not correctly make use of its discretion under Article 114(1) EPC when admitting A7 into the proceedings; indeed the Opposition division considered that A7 was prima facie relevant and in exercising its discretion decided to admit it into the proceedings.

- 3.2 The Respondent argued that if A6 were admitted into the appeal proceedings, the case should be remitted to the first instance since A6 has not been discussed in the opposition proceedings.

According to the jurisprudence of the Boards of Appeal, a patent proprietor has no automatic right of remittal after the citation of a new document, at least in cases where the document is filed in reaction to amendments of the claims, providing that both parties' right to a fair hearing (Article 113(1) EPC) is not jeopardised (see decision T 402/01 of 21 February 2005, point 10 of the reasons). This is here clearly the case: A6 has been cited against the third auxiliary request during the opposition proceedings.

Moreover, since the Respondent has already taken position on this citation, the Board considers that a remittal to the first instance for discussing A6 would only unduly delay the outcome of the proceedings.

4. *First and second auxiliary requests:*

- 4.1 Claim 1 of the first auxiliary request differs from that of the main request only by the additional feature that "the angular extension ( $\emptyset a$ ) of the outlet edge (6) taking the rotational direction into account, is larger than the corresponding angular extension ( $\emptyset i$ ) of the inlet edge (5)". This feature is disclosed page 6, lines 5 to 10 of the application as filed (WO-A-98/05863).

Claim 1 of the second auxiliary request adds with respect to the first auxiliary request that  $\emptyset i$  is at

least equal to  $15^\circ$ . This additional feature is disclosed page 6, lines 11 to 14 of the application as filed.

4.2 Figure 5 of A7 shows a runner wherein the angular extension of the blade outlet edge taking the rotational direction into account, is larger than the corresponding angular extension of the blade inlet edge.

4.3 The Respondent argued that Figure 5 of A7 is a schematic drawing from which no measurements can be taken. Furthermore, no precise location of point C can be inferred from this figure whose purpose is to illustrate how the runner can be split into two halves.

However, even if A7 refers to Figure 5 for illustrating another purpose, this figure is indicative of the proportions of the blades. Obviously it represents a grid corresponding to a mathematical calculation of a meridian section of the runner and thus, an exact representation of the blades profiles. Therefore, the extension of blade inlet edge can be compared to the extension of the blade outlet edge, and it is clear even without taking measurements that Figure 5 of A7 exhibits the claimed feature, even when considering that the point C is located in the most unfavourable possible position.

4.4 The Respondent further argued that there is no link between A7 and A1 so that a skilled person would not be incited to use features of A7 in a runner according to A1.

In A1, section 1.4 it is stated "a stabilizing effect for skewed blade outlets has also been observed for runners without splitter blades. The reason for this may be that the blade outlets are located on a smaller diameter on the crown for runners with skewed blades, than for runners with radial blades..." This means, as can be seen when comparing Figure 6a with Figure 6b, that point D has been moved down on the hub (crown) profile. This implies in turn that the angular extension of the outlet edge becomes larger as the skew increases. Since Figure 6 of A1 is a schematic drawing from which no precise angular value can be inferred and A1 does not indicate the ratio between the extension of the inlet and outlet edges, a skilled person would therefore be incited to look for this ratio in other state of the art runners of the type disclosed in A7.

4.5 Consequently the subject-matter of claim 1 according to the first auxiliary request does not involve an inventive step.

4.6 It is unclear what technical problem should be solved by providing an angle  $\theta_i$  which is at least equal to  $15^\circ$ .

The Respondent argued that this feature contributes to solve the problem of the invention as stated in the patent specification.

However, although it is stated in the patent specification that "it is desirable that ...  $\theta_i$  ... is at least equal to  $15^\circ$ " no specific effect which could arise from the claimed angular range has been described in the patent specification.

Once the development of a runner which is less subject to cavitation and has improved pressure stability became obvious from the cited prior art, determining other dimensional parameters, in particular the lower limit of the angular range for  $\theta_i$  is then purely a matter of routine experimentation for the skilled person and cannot therefore make an inventive contribution to the claimed runner.

Consequently the subject-matter of claim 1 according to the second auxiliary request does not involve an inventive step either.

5. *Third auxiliary request:*

5.1 The third auxiliary request comprises with respect to claim 1 as granted, the additional features of claim 3 as granted, according to which "the ratio between the diameters ( $D_d$  and  $D_b$ ) at the attachment points of the outlet edge at the hub (2) and the ring (1), respectively, is between 0,3 and 0,4".

5.2 In A6 there are shown several runners for Francis turbines exhibiting the claimed ratio.

In the introductory part of A6 it is stated: reference book and working tool, this book ... presents a huge panel of modern hydraulic turbo-machines comprising all types of turbines Pelton, Francis, Kaplan ... and [this book] is intended for a large public ranging from design engineers for turbines to students.

A6 can thus be considered as reference book reflecting the actual design standards in the technical field of hydraulic turbines.

Since at least six of the runners shown in A6 exhibit the claimed diameter ratio, this feature is to be considered as a standard design option which accordingly does not involve an inventive step.

The Respondent argued that not all runners shown in A6 do exhibit the claimed diameter ratio. However, on the one hand he failed to identify a runner in A6 that could support this allegation; on the other hand the fact that not all runners exhibit the claimed feature does not alter the fact that it was commonly used.

The Respondent also argued that a skilled person would refrain from using in isolation a feature of a known runner which has been built for specific working conditions in another runner built for other working conditions. However, at least six of the runners of A6 exhibit the claimed feature, this is an indication that this feature is not linked to specific working conditions; moreover the patent in suit too claims this feature independently of any specific working condition.

- 5.3 Consequently, the subject-matter of claim 1 according to the third auxiliary request does not involve an inventive step.

6. *Sixth and seventh auxiliary requests:*

6.1 Claim 1 of the sixth auxiliary request comprises the features of claim 1 of the first auxiliary request and the features of claims 3 and 4 as granted. Claim 1 of the seventh auxiliary request comprises the features of claims 1 to 4 as granted.

6.2 The sole additional feature which has not been discussed with reference to the first to third auxiliary requests is that the attachment point (D) of the outlet edge at the hub is located lower than the middle point of the blade inlet edge.

This feature too is present in several runners shown in A6 and is therefore to be considered as a standard design option. Furthermore, as explained in section 4.4 above, the more the skew of the blade outlet edge increases the more the attachment point D is located on a smaller diameter of the hub profile, i.e. the more it moves down with respect to the middle point of the blade inlet edge.

Accordingly, this feature cannot be seen as involving an inventive step either.

The Respondent argued that the invention lies in the combination of features which define the most important parameters for obtaining the sought advantages.

However, the patent specification clearly states that the forward skew of the blade inlet edge solves the cavitation problem (paragraph [0004]) whereas the forward skew of the blade outlet edge has a stabilizing

effect on the water flow through the turbine (paragraph [0005]). Moreover, the additional dimensional requirements claimed in claim 1 of the sixth and seventh auxiliary requests (with respect to claim 1 of the main request) are known per se and proceed from the position of the attachment point D, i.e. the angle of the blade outlet edge and there is no indication in the patent specification that these additional features show a combinative effect that goes beyond the sum of their individual effects.

As already stated, once the development of a runner which is less subject to cavitation and has improved pressure stability becomes obvious from the cited prior art, determination of other dimensional requirements, such as those claimed in the sixth and seventh auxiliary requests is purely a matter of routine experimentation.

Accordingly, these features cannot add anything of inventive significance to the subject-matter of the claim.

- 6.3 Consequently, the subject-matter of claim 1 according to the sixth and seventh auxiliary request does not involve an inventive step.
7. In light of the above, the cited prior uses were not considered by the board, neither as to admissibility nor as to substance.

**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