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Datasheet for the decision of 20 October 2022

Case Number: T 0231/19 - 3.2.04

Application Number: 13743042.7

Publication Number: 2809931

IPC: F02K3/02, F01D1/24, B63H5/10, F02C3/107, F01D5/02, F02K3/06

Language of the proceedings: EN

Title of invention:
GEARED TURBOFAN GAS TURBINE ENGINE ARCHITECTURE

Patent Proprietor:
Raytheon Technologies Corporation

Opponent:
Safran Aircraft Engines

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - main request (no)
Inventive step - auxiliary requests (no)
no plausible technical effect

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 0231/19 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 20 October 2022

Appellant: (Patent Proprietor)	Raytheon Technologies Corporation 10 Farm Springs Road Farmington, CT 06032 (US)
Representative:	Dehns St. Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Appellant: (Opponent)	Safran Aircraft Engines 2 boulevard du Général Martial Valin 75015 Paris (FR)
Representative:	Regimbeau 20, rue de Chazelles 75847 Paris Cedex 17 (FR)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 26 November 2018 concerning maintenance of the European Patent No. 2809931 in amended form.**

Composition of the Board:

Chairman	A. de Vries
Members:	S. Oechsner de Coninck
	C. Heath

Summary of Facts and Submissions

I. The proprietor and the opponent both appeal against the interlocutory decision of the Opposition Division of the European Patent Office posted on 26 November 2018 concerning maintenance of the European Patent No. 2809931 in amended form.

II. The Opposition Division held that granted claim 1acked an inventive step, whereas claim 1 as amended according to a second auxiliary request did involve an inventive step having regard to the following document in particular:

D1: B. Gunston: "Jane's Aero-Engines", Issue Seven, UK, March 2000, pages 510-512.

III. Oral proceedings were held on 20 October 2022.

IV. The appellant-opponent requests that the decision be set aside and the patent be revoked.

V. The appellant-proprietor requests that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of a main request, first or second auxiliary request filed or re-filed with letter dated 22nd August 2019.

VI. The independent claim 1 according to the relevant requests reads as follows:

Main request (patent as granted)

"A gas turbine engine (20) comprising:
a fan (42) rotatable about an axis (A);

a compressor section (24);
a combustor (56) in fluid communication with the compressor section (24);
a turbine section (28) in fluid communication with the combustor (56), the turbine section (28) including a fan drive turbine (46) and a second turbine (54), wherein the second turbine (54) is disposed forward of the fan drive turbine (46), and the fan drive turbine (46) includes at least one rotor (116) having a bore radius (R) and a live rim radius (r); and
a speed change system (48) driven by the fan drive turbine (46) for rotating the fan (42) about the axis (A),
characterised in that:
a ratio of r/R is between 2.00 and 2.30."

First auxiliary request:

Claim 1 adds to granted claim 1 the following wording at the end:
"wherein the bore radius (R) includes at least one bore width (W) in a direction parallel to the axis of rotation (A) and a ratio between the bore width (W) and the live rim radius (r) is defined by r/W between 4.65 and 5.55"

Second auxiliary request

Claim 1 is as claim 1 of the first auxiliary request with the following amendments (emphasis added by the Board)
"...and a ratio <u>of</u> ~~between~~ the bore width (W) ~~and~~ <u>to</u> the live rim radius (r) is ~~defined by r/W~~ between 4.65 and 5.55".

VII. The appellant proprietor argues as follows:
- The skilled person infers from the patent that the narrow range of ratios r/R defined in claim 1 corresponds to an optimum balance between strength and rotor weight. Such a "sweet spot" would be unexpected and justify an inventive step.
- The further range of ratios r/W defined in claim 1 of auxiliary requests 1 and 2 provides a further effect in addition to the former r/R ratio and is not suggested by the cited prior art.

VIII. The appellant opponent argues as follows:
- Starting from the low pressure turbine disclosed in D1, the skilled person would obviously have provided a live rim to bore radius r/R within the range defined in claim 1, using routine dimensioning skills.
- The further range of ratios r/W defined in claim 1 of auxiliary requests 1 and 2 does not provide a synergistic effect with the former r/R ratio and the skilled person would also have provided a disc width that also falls within the range r/W of claim 1 as an additional measure.

Reasons for the Decision

1. The appeals are admissible.

2. Main and auxiliary requests - inventive step

2.1 D1 is an excerpt from Jane's Aero-Engines book, a widely recognized technical publication in the aeronautical field. On the bottom of page 510 a 3D cutaway drawing of a Pratt and Whitney PW8000 geared turbo-fan engine is depicted and on the bottom of page 511 a longitudinal section of the same PW8000 engine is

represented. It is undisputed that the geared turbo-fan engine disclosed in D1 comprises the features of the preamble of claim 1 and especially a fan drive turbine ("Turbine") and a second turbine ("1 stage High Turbine") disposed further forward, wherein the fan drive turbine includes at least one rotor having a bore radius (visible between the lower end of each disc and the axis) and a live rim radius (depicted as the lower straight horizontal line in the upper part of the disc). The speed change system is also shown and referenced as the fan drive gear system.

2.2 However, exact values of the ratio of live rim radius to bore radius r/R are not expressly stated in D1. Leaving aside the question whether a value for the ratio within the claimed range might be derivable from the figures, that claimed range is not seen to involve an inventive step for the reasons given below. In the following, it thus assumed that the claimed range of values between 2.00 and 2.30 forms the distinguishing feature of the engine of claim 1 over D1.

2.3 Applying the problem solution approach, the objective technical problem must be formulated based on any effects or advantages associated with the claimed range of values and as can be derived from the patent in light of the cited prior art.

The proprietor appellant refers to the paragraphs 077 to 079 of the description, more particularly to the "increased performance attributes and performance" mentioned in paragraph 079. Read in the context of the preceding paragraphs the skilled person would understand this to refer inter alia to the the narrow range of ratios r/R defined in paragraph 077 and featured in claim 1. In the view of the appellant

proprietor, this range would represent an optimum balance between strength and rotor weight and this technical effect would be plausible to the skilled person. As further argued at the oral proceedings, it would indeed constitute a "sweet spot" in engine performance that would be unexpected and surprising.

2.4 In the Board's view, however, and as argued by the appellant opponent (statement of grounds, section III; letter of 21 August 2019, pp 4,5; letter of 31 December 2021, p.4 ff), such an effect cannot be confirmed. In particular, it is not plausible to the Board on the basis of the information presented in the patent that such a design sweet spot (in the sense of a most favourable combination of factors) exists, or, if so that it would be unexpected. Firstly, the patent provides no data whatsoever that might demonstrate that a sweet spot exists. It gives no values for the ratio r/R in conventional turbines, nor does it present data for performance attributes in relation to ratio r/R that might demonstrate that there is an increase in comparison to conventional turbines, let alone an unexpected one.

2.5 Nor do paragraphs 076 to 079 read in conjunction provide a credible explanation why ratio values within the claimed range would be special, let alone represent a sweet spot that is unexpected. Paragraph 076 simply defines the various design parameters. Paragraph 077 then relates the ratio to increased speed of the compact turbine design (without any speed values). Paragraph 078 discusses other parameters (bore widths and the ratio of live rim radius to board width) for which it blandly states ranges without effects. Finally, paragraph 079, which refers to "increased performance attributes and performance ... provided by

desirable combinations of the disclosed features", does so without indicating which attributes are meant or by which combination of features this is achieved. It is a catch-all passage that is so unspecific as to be virtually meaningless. This passage relating to various unspecified components present in all the different gas turbine engine embodiments described in the patent does not identify which ones of the numerous features addressed in the patent are meant, in which combination, or even whether a whole gas turbine architecture disclosed in the embodiments of figures 2 to 9 is referred to.

Thus, contrary to the proprietor appellant's opinion, paragraphs 076 to 079 do not relate the range of r/R ratios to any specific sweet spot in the operation or design of a turbine.

2.6 This leaves only paragraph 077 and its stated relationship of the ratio to an increased speed. Here, the appellant proprietor has argued that the ratio characterizes the ideal stiffness and weight properties of the disk that would allow increased speeds.

Even if it were accepted that the ratio r/R is a design parameter indicative of disk stiffness and that the chosen range defines a range of suitable stiffness values for the speeds of the low spool, as argued by the appellant proprietor, prior art low pressure turbines such as that of D1 must necessarily also be designed with sufficient disk stiffness to be able to operate in their speed range. This is why the low and high pressure stages of the low pressure compact turbine of D1 shown in the figure have different dimensions adapted to their respective speeds.

Without any indication of how the low spool speeds are increased vis-a-vis the prior art and how the ratio compares with the prior art, it is impossible for the Board to be able to conclude with any degree of certainty that the claimed ratio range is out of the ordinary or goes beyond said routine optimization of a turbine design. Here, the Board stresses that it is incumbent on the appellant proprietor to demonstrate convincingly in the patent, e.g. by supporting data (comparative tests, say) or a credible explanation that values of a new parameter are associated with an alleged effect of advantage, cf. Case Law of the Boards of Appeal, 10th edition 2022, I.D.4.3.1, see also I.C. 5.2.3 in relation to novelty and unusual parameters. Merely introducing a new parameter (such as the ratio of the radii of the live disk and the bore) to characterize turbine design in a new way or to identify a design as the product of routine optimization does not render the design inventive.

2.7 For these reasons, the Board confirms the opposition division's finding that the subject-matter of claim 1 of the main request lacks an inventive step.

3. First and second auxiliary requests

3.1 Claim 1 according to the first and second auxiliary requests uses different formulations to add the further limitation concerning ratio r/W between bore width and live rim radius, which should lie between 4.65 to 5.55.

3.2 The reasons given above in relation to the range of ratios r/R also apply to the range of values for the ratio r/W. Thus, the patent fails to plausibly associate any special or specific technical effect with

the claimed range of ratios r/W. The particular range of ratios r/W is derived from paragraph 078 of the patent which merely gives the range without any mention of a particular advantage or effect associated with this range. As above, the broad catch-all statement in paragraph 079 does not identify which "performance attributes" are increased or in what measure, nor which specific combination of features would be responsible for an increase. Nor is it made plausible in the patent by supporting data or an explanation that there would be some synergistic effect between these two ranges of values of r/R and r/W.

3.3 Contrary to the decision under appeal, the Board thus finds for the same reasons as stated for the main request that the further range of ratios for the bore width to live rim radius does not involve an inventive step. This finding applies also to claim 1 of auxiliary request 2 which merely reformulates the subject-matter of claim 1 of the auxiliary request 1.

4. As no allowable request remains, the Board must revoke the patent pursuant to Article 101(2) and (3)(b) 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 A. de Vries

Decision electronically authenticated