Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 21 July 2021

Case Number: T 3030/18 - 3.2.04

Application Number: 11169267.9

Publication Number: 2420665

IPC: F02K1/06, F02K1/08, F02K1/15, F02K3/06

Language of the proceedings: EN

Title of invention:
Variable area fan nozzle

Patent Proprietor:
Raytheon Technologies Corporation

Opponent:
Safran Aircraft Engines

Headword:

Relevant legal provisions:
EPC Art. 54, 56
RPBA Art. 12(4)

Keyword:
Novelty - main request (no)
Inventive step - auxiliary request (yes)
Request filed as reply to appeal - taken into account (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 3030/18 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 21 July 2021

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 October 2018 concerning maintenance of the European Patent No. 2420665 in amended form.**

Composition of the Board:

Chairman	A. de Vries
Members:	S. Oechsner de Coninck
	T. Bokor

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 October 2018 concerning maintenance of the European Patent No. 2420665 in amended form.

II. The opposition was based on the grounds of Article 100(a) EPC in combination with Articles 54 and 56 EPC for lack of novelty and inventive step. In its written decision the opposition division held that granted claim 1 lacked novelty but that the patent as amended according to the auxiliary request 1 met the requirements of the EPC, having regard in particular to the following documents:

D5: US 4,807,434
D6: EP 0779429
D7: US 2010/0064659
D12: "Fundamentals of Aerodynamics", Naval Aviation Schools Command, Pensacola, US, April 2008.

III. Oral proceedings were held on 21 July 2021 in the form of a videoconference.

IV. The appellant proprietor requests that the decision under appeal be set aside and the patent be maintained as granted (main request). Auxiliarily they requests to maintain the patent in an amended form on the basis of one of the auxiliary requests 1 to 8, where auxiliary requests 1, 6 to 8 were filed with letter dated 18 July 2019, and auxiliary requests 2 to 5 were filed with letter dated 10 May 2021.

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

VI. The wording of claim 1 of the main request and auxiliary request 1 is as follows:

Main request

"A nacelle assembly for a gas turbine engine (10) comprising:
a core nacelle (12) defined about an engine centerline axis (A);
a fan nacelle (34) mounted at least partially around said core nacelle (12) to define a fan bypass flow path (40);
a variable area fan nozzle (42) in communication with said fan bypass flow path (40), said variable area fan nozzle (42) having a first fan nacelle section and a second fan nacelle section (54); and
an actuator assembly (56) operable to move said second fan nacelle section (54) relative to said first fan nacelle section (52) to vary a fan nozzle exit area and adjust fan bypass airflow;
characterised in that said actuator assembly (56) extends at least partially into said fan bypass flow path (40)."

Auxiliary request 1 (with amendments underlined with respect to the Main request)

1. A nacelle assembly for a gas turbine engine (10) comprising:

a core nacelle (12) defined about an engine centerline axis (A);

a fan nacelle (34) mounted at least partially around said core nacelle (12) to define a fan bypass flow path (40);

a variable area fan nozzle (42) in communication with said fan bypass flow path (40), said variable area fan nozzle (42) having a first fan nacelle section and a second fan nacelle section (54); and

an actuator assembly (56) operable to move said second fan nacelle section (54) relative to said first fan nacelle section (52) to vary a fan nozzle exit area and adjust fan bypass airflow;

characterised in that said actuator assembly (56) extends at least partially into said fan bypass flow path (40)~~.~~,

~~2. T~~wherein the assembly ~~as recited in claim 1,~~ further compris~~cs~~ing an actuator fairing (62) which encloses said actuator assembly (56)~~.~~,

wherein said actuator assembly (56) extends radially inward toward said engine centerline axis (A),

wherein said actuator fairing (62) extends radially inward toward said engine centerline axis (A).

VII. The Appellant-Proprietor argued as follows:

- In D5 the actuator extends in an auxiliary flow path different from the bypass flow path, nor does D5 disclose a variable fan nozzle. Therefore claim 1 as granted is novel.
- Auxiliary request 1 is admissible.
- Claim 1 according to auxiliary request 1 requires an extension of the actuator assembly and fairings towards the inner bypass flow path which is not shown by the cited prior art. The subject-matter of claim 1 is therefore novel and inventive.

VIII. The Appellant-Opponent argued as follows:
- Claim 1 is broad, and only requires a flow path defined between the fan and core engine nacelles. In D5 the area variation is caused by the movement of the actuator, as in the patent. The flow in the bypass flow through the cascades will affect the actuator 98 as well. D5 therefore anticipates all features of granted claim 1.
- Auxiliary request 1 should have been filed in opposition and should not be admitted.
- In claim 1 according to auxiliary request 1 "radially inwards" does not define any reference position from which the inwards direction is taken. D5, D6 and D7 all disclose actuators that have some radial extension. Therefore all are novelty destroying for the subject-matter of claim 1 of auxiliary Request 1. Assuming a radially extending fairing is not shown in D7, it falls within the knowledge of the skilled person to provide such fairing to streamline the flow path around the actuator.

Reasons for the Decision

1. The appeals are admissible.

2. Background - interpretation of granted claim 1.

2.1 The patent concerns a nacelle assembly for a gas turbine engine, more particularly the actuator system of its aft nozzle portion, that is used to provide a smaller fan exit nozzle during cruise conditions and a larger fan exit nozzle during take-off and landing conditions (paragraph 002).

2.2 For fuel efficiency reasons it is sought to increase fan size on existing engines but the actuators needed to move the aft part of the fan nacelle limit the possible increase in diameter (paragraph 003). To overcome this problem, the invention relies on placing the actuator assembly not on the outside of the fan nacelle but so that it extends at least partly into the fan bypass flow.

2.3 The wording of claim 1 concretely realises the above core concept by first defining a core nacelle and a fan nacelle around the core to define a fan bypass flow path. From this broad definition no further spatial limitations of the bypass flow path, especially as concerns its outlet are derivable. What is however derivable by the skilled person using their technical understanding is that this configuration is common for any ducted turbofan engine: enclosed within the outer fan nacelle at the upstream edge of the core nacelle, the inlet flow is split between a core flow and bypass flow, whereby the bypass flow is channeled on the outer side of the core nacelle and outwardly limited by the fan nacelle. A bypass flow path is understood as a channel that ducts airflow from the main airflow into the engine at the the bypass inlet away from the inner core nacelle inlet to a bypass outlet. At its inlet the bypass flow path is annular and surrounds the core nacelle, and the entire bypass airflow that enters at this inlet is exhausted further downstream of the engine through the exit area of a fan nozzle.

2.4 The fan nozzle is defined in claim 1 to be variable and in communication with the fan bypass flow path. It includes a second fan nacelle section movable with respect to a first fan nacelle section by an actuator assembly to vary the fan nozzle exit area and adjust

fan bypass flow. Apart from being varied by relative movement of both fan sections, the geometry and location of the exit area of the fan nozzle is not further defined.

2.5 Therefore and contrary to the appellant proprietor's view the wording of claim 1 neither limits the fan bypass flow path and its outlet or nozzle to the sole central annular path between the second -aft- nacelle section and core engine nacelle, nor does it limit the variable fan nozzle area to the difference in size of the exhaust annular section at the downstream tip of the second fan nacelle with respect to the tapering core engine nacelle once translated.

2.6 The passage of the description in paragraphs 011 and 018 further referred to by the appellant proprietor to support their interpretation of the bypass flow path being limited to the generally annular flow path 40 and the variable fan nozzle exit area being limited to the sole exit area 44 should be read in context. The last sentence of immediately preceding paragraph 017 explicitly states that the exit area F1 together with auxiliary port 60 in Figure 4 is greater than exit area F0. Thus, also the auxiliary port adds to the annular nozzle area to obtain the total available exit nozzle area, and therefore air passing through the auxiliary port also forms part of the bypass flow.

3. Main request - Lack of novelty with respect to D5

3.1 D5 discloses a thrust reverser for a high bypass gas turbine engine (col 1, lines 7-9) that comprises a nacelle assembly comprising a core nacelle 62 and a fan nacelle 66 mounted at least partially around said core nacelle to define a fan bypass flow path. Figures 4 and

5 relate to the same first embodiment and show an aft portion 70 of nacelle 66 configured as an annular sleeve, including a plurality of pockets 96 between an exterior skin 90 and an interior surface 88 in which cascaded vane sections 84 are each sized to fit. Four linear actuators 98 are disposed at spaced-apart intervals around the circumference of aft portion 70 to move the aft portion back and forth (column 4, lines 29-44, figure 4). The inner surface 88 of aft portion 70 includes a plurality of pivotable blocker panels 94, each connected to the inner surface of annular ring 82 of the fan nacelle by means of corresponding links 104 comprising internal shafts 116 extendable from cylinders 115 (column 5, lines 14 to 28; figure 5). These links effect rotation of the blocker door via an intermediate position shown in figure 7 to effect full deployment of the thrust reverser as shown in figure 8 and block all bypass flow (col 6, lines 8-9).

3.2 The intermediate position of the thrust reverser shown in figure 7 is further explained in column 5, lines 46 to 50. Contrary to the appellant proprietor's opinion, the Board understands this intermediate position to be an actual position that may be selected when appropriate adaptation of the flight behaviour is required. Such a flight condition is expressly referred to in D5, column 1, lines 16 to 20 to include slowing down the aircraft during cruise. This might for example also occur during approach when the aircraft is above its glide path and needs to quickly retrieve the required approach flight slope. The prevention of inadvertent deployment during flight relied upon by the proprietor in relation to column 6, lines 53 to 55, rather concerns the ability of the thrust reverser system to ease retraction under high power conditions. During high power operation -take off or cruise- any

inadvertent deployment would have catastrophic consequences and D5 explains that retraction is made easier should this unexpectedly happen. Thus rather than prohibiting partial deployment under all circumstances, this statement does not contradict the partial deployment during cruise to slow down the aircraft foreseen in column 1, lines 16-20 of D5.

3.3 The Board furthermore holds that in the intermediate position explained above in relation to figure 7, the area of the bypass is also effectively varied. This occurs in the aft annular section because the trailing edge of the aft portion 70 together with the conical aft end core 64 defines a different section than in the retracted position. More particularly, moving from the closed position of figure 5 to this latter position of figure 7 the physical area and geometry of the bypass flow path through the nozzle exit area or annular area 74 formed between the fan nacelle 66 and central tapering core 62 changes in a manner similar to that shown on figures 3 and 4 of the patent with the space between blocker panel 94 and the core aft end 64 (see core nacelle taper 64 in figure 8) increasing as the latter drops away. Thus, the thrust reverser up to partial deployment effectively acts as a variable area fan nozzle.

3.4 In addition the Board cannot follow the appellant proprietor's argument that the auxiliary passage opened through the cascaded vane section 84 shown in figure 7 does not form part of the bypass flow path according to claim 1. This airflow passage is expressly mentioned as exhausting a portion of the bypass airflow while a majority of bypass airflow continues to flow through the nozzle 74 (col 5, lines 62-66). It thus acts to open an additional exit area in the same manner and of

the same nature as the auxiliary passage of the patent, as explained in item 2.6 above. The part of the airflow flowing through the turning vanes 110 of the cascaded vane section is deflected radially outward and forward of the engine. This deflected bypass airflow is easily seen to provide an air braking effect on the aircraft and to thus slow it down while cruising, as mentioned in col 1, lines 16-20.

3.5 Opening the auxiliary passage in the varied nozzle area of figure 7 exposes the actuator assembly 98 to bypass air flowing radially outwardly through that passage, so that at least in that position the actuator assembly extends into the fan bypass flow path as required by claim 1. Contrary to the appellant proprietor's opinion the Board does not see the assembly 98 as shielded from air flow by their position within the sections. As is evident from figure 4, but see also figures 9 and 10, the actuator assembly 98 with brackets 102 is received within an open space between two sections 84, so that the whole assembly including brackets is necessarily exposed when the aft portion 70 is moved away from the nacelle end portion 800. Even if the actuator assembly 98 includes a sleeve surrounding the rod as shown in figure 10, this does not negate the fact that the whole assembly extends into the flow path, just as in the patent, claim 2 and figures 5 and 6.

3.6 It follows from the above that in the intermediate position of the thrust reverser of D5 the actuator assembly 98 extends at least partially into the fan bypass flow path opened through the cascaded vane section 84 as shown in figure 7 as required by the characterising portion of claim 1 of the patent.

3.7 The Board thus confirms the decision's finding that the subject-matter of claim 1 as granted lacks novelty in view of D5.

4. Auxiliary request 1

4.1 Admission

4.1.1 The request was filed with the appellant proprietor's letter of 18 July 2019. This request corresponds to previous auxiliary request 1 forming part of the impugned decision, in that it adds to claim 1 the features of granted dependent claims 2, 5 and 6, but is modified in that it does not retain the inner diameter of the nacelle as reference for the extension of the fairing. The appellant opponent contests its admission with the argument that this request was not part of the proprietor's appeal case, even though on filing of their appeal they would and should have been familiar with the objections of the opponent.

4.1.2 In view of the fact that this new request has been filed at the suitable stage of the appeal proceedings according to Article 12(2) RPBA 2007, and in response to the appellant opponent's grounds to overcome the objection raised under Articles 84 and 123(2) against the previous auxiliary request 1, this request is to be considered as the proprietor's reply to the appeal of the opponent. In the opinion of the Board, the rights of a party as respondent are not affected because the party is also appellant. Thus the proprietor's reply to the appeal of the opponent must be considered as part of their case pursuant to Article 12(2) and (4) RPBA 2007 (Article 25(2) RPBA 2020).

4.1.3 Moreover, contrary to the appellant opponent's opinion the Board does not consider the filing of this request to be against procedural economy as it deletes contested features and thus resolves the issues of Articles 84 and 123(2) EPC raised against previous auxiliary request 1 and repeated in the opponent's grounds of appeal.

4.1.4 For these reasons, the Board execising its discretion does not hold this request inadmissible and takes it into account, Articles 12(2) and (4) RPBA 2007.

4.2 Clarity, added subject-matter

The amendments to claim 1 of the present version of auxiliary request 1 vis-a-vis the previous version on which the decision was based address by removal of the objectionable feature (of the inner diameter) the objections of clarity and added subject-matter raised by appellant opponent against this feature in their grounds. Indeed claim 1 of this request is a straightforward combination of granted claims 2, 5 and 6 corresponding to the like number claims as filed. The claim thus meets the requirements of Article 123(2) EPC, while clarity is no longer an issue.

4.3 Interpretation

Claim 1 of the auxiliary request 1 adds the features of granted claims 2, 5 and 6 as follows: "...and an actuator fairing (62) which encloses said actuator assembly (56), wherein said actuator assembly (56) extends radially inward toward said engine centerline axis (A), wherein said actuator fairing (62) extends radially inward toward said engine centerline axis (A)."

The expression "radially inward toward said engine centerline axis", which is taken from granted claims, in the appellant opponent's opinion is to be read as merely requiring that the actuator and fairing have some width in a radial direction so that it would always apply to any component having a certain thickness in the radial direction. The Board rather follows established jurisprudence and reads the expression contextually in order to make technical sense of the claim. In that contextual reading the further qualification "inward" should be understood in conjunction with the previous requirement that the actuator extends into the fan bypass flow path. Thus the actuator assembly and its enclosing fairing project inwardly of the fan nacelle into the fan bypass flow path, that is towards the interior of the fan nacelle.

4.4 Novelty

4.4.1 With the above interpretation, the subject-matter of claim 1 not only differs from D5, D6 and D7 by the provision of a fairing but also by the extension of both the actuator assembly and its fairing towards the inside of the fan bypass flow path, that is inwardly of the fan nacelle.

4.4.2 In more detail, in D5 the actuator assembly 98 and the receiver 100 that encloses the actuator 98 both extend parallel to the engine centerline within the wall of the nacelle to project in a downstream direction from the *outer* side of the nacelle, and therefore can neither anticipate nor hint at providing an actuator with fairing extending radially inward in the above sense of projecting inwardly of the fan nacelle. The filler panels 114 (figures 9 and 10) and the blocker

panels 94 referred to by the appellant opponent as providing a protection against drag from the bypass airflow for the actuator 98 (column 6, line 32 to 45) also fail to project inwardly of the fan nacelle of which they form the inner wall.

4.4.3 D6 discloses a similar gas turbine engine equipped with a variable area fan exhaust nozzle. The fan exhaust nozzle sleeve 38 that effects variable area by translation with respect to the core cowl 26 is moved by a plurality of hydraulic actuators 76 (col 6, lines 3-9, fig. 2, 3). These actuators 76 however do not extend in any way into the bypass flow path. Though the blocker panels 50 of a thrust reverse mechanism may shield the actuators 76 the skilled person would not recognize them as fairings.

4.4.4 D7 discloses a variable area fan nozzle assembly 12 with translating nozzle 50, see for example figure 8. According to paragraph 035 the translating nozzle 50 effects a desired size of the upstream exit 60 and also varies the outlet geometry and effective exit area A_{exit} of the downstream nozzle exit 52. Translation is effected by actuators 70 that extend from a sleeve section 82 and connect to a forward portion of the nozzle section 54, but are enclosed within the nacelle wall as is apparent from figure 8. Outer upstream fairings 324 and downstream fairings 328 are disclosed in paragraph 050, see also figures 10 and 11, that provide aerodynamic protection against outside airflow for the actuator shafts 272. Being nested inside the thickness of the fan nacelle wall, the actuators are thus conveniently protected against drag from the bypass airflow.

4.4.5 Inventive Step

4.4.6 The Board cannot follow the arguments of lack of an inventive step starting from any of D5, D6 or D7 combined with the skilled person's common knowledge. These arguments all rely on the above contention that the actuator assembly merely needs to have some extension in the radial direction to anticipate the added features. It is thus not enough to merely provide a fairing, which all parties agree is a very well known measure to reduce drag, see inter alia D12, page 68, to arrive at the claimed subject-matter.

4.4.7 Instead, as explained in paragraph 003 of the patent the extension of both an actuator and its fairing within the main bypass flow cooperate to provide a configuration advantageous to increase fan diameter while keeping a limited external diameter of the fan nacelle. The associated problem may thus be seen as to propose an improved actuator assembly suitable for a compact fan nacelle.

4.4.8 The Board is unconvinced that it would be common general knowledge to simply move the actuator (with or without additional fairing) further inwards from its position in any of D5, D6, D7 to a position where it projects inwardly of the fan nacelle. Such a modification, which is not suggested by any other cited document, appears neither simple nor straightforward. In each case moving the actuator further inward would interfere with other components, in particular blocker panels 94 (D5), 50 (D6), 134 (D7).

4.4.9 In view of the above the Board concludes, that the subject-matter of claim 1 of auxiliary request 1 involves an inventive step over any of D5,D6 or D7 in combination with the skilled person's common general knowledge, and therefore fulfills the requirements of Articles 52(1) and 56 EPC.

5. In conclusion the Board confirms the division's finding of lack of novelty over D5. Considering the amendments made to the patent according to auxiliary request 1, the Board furthermore concludes that the patent and the invention to which it relates meet the requirements of the EPC, and that therefore the patent can be maintained as amended, but for the adaptation of the description, Art 101 (3)(a) EPC. Concerning the latter, the parties agreed to a remittal of the case to the Opposition Division.

Order

For these reasons it is decided that:

1. **The decision under appeal is set aside.**

2. **The case is remitted to the Opposition Division with the order to maintain the patent with the following claims and a description to be adapted thereto:**
Claims: No. 1 to 9 filed as Auxiliary Request 1 with letter dated 18 July 2019.

The Registrar: The Chairman:

G. Magouliotis A. de Vries

Decision electronically authenticated