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**Datasheet for the decision  
of 9 March 2022**

**Case Number:** T 0335/19 - 3.2.04

**Application Number:** 12172297.9

**Publication Number:** 2535547

**IPC:** F02K1/38, F02K1/76

**Language of the proceedings:** EN

**Title of invention:**

Apparatus for linear actuation of flow altering components of jet engine nozzle

**Patent Proprietor:**

General Electric Company

**Opponent:**

Raytheon Technologies Corporation

**Headword:**

**Relevant legal provisions:**

EPC Art. 84, 123(2), 56

RPBA 2020 Art. 12(2)

**Keyword:**

Claims - clarity (yes)

Amendments - extension beyond the content of the application  
as filed (no)

Inventive step - (yes)

Late-filed evidence - error in use of discretion at first  
instance (no)

**Decisions cited:**

G 0003/14

**Catchword:**



**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 0335/19 - 3.2.04

**D E C I S I O N**  
**of Technical Board of Appeal 3.2.04**  
**of 9 March 2022**

**Appellant:** Raytheon Technologies Corporation  
(Opponent) Pratt & Whitney  
400 Main Street  
East Hartford, CT 06118 (US)

**Representative:** Dehns  
St. Bride's House  
10 Salisbury Square  
London EC4Y 8JD (GB)

**Respondent:** General Electric Company  
(Patent Proprietor) 1 River Road  
Schenectady, NY 12345 (US)

**Representative:** Grünecker Patent- und Rechtsanwälte  
PartG mbB  
Leopoldstraße 4  
80802 München (DE)

**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
19 November 2018 concerning maintenance of the  
European Patent No. 2535547 in amended form.**

**Composition of the Board:**

**Chairman** A. de Vries  
**Members:** S. Oechsner de Coninck  
K. Kerber-Zubrzycka

## **Summary of Facts and Submissions**

- I. The opponent appeals against the interlocutory decision of the Opposition Division of the European Patent Office posted on 19 November 2018 concerning maintenance of the European Patent No. 2535547 in amended form.
  
- II. The opposition was based on the grounds of Articles 100(a) EPC in combination with lack of novelty and inventive step. In its written decision the opposition division held that the patent as amended according to the fourth auxiliary request met the requirements of the EPC, having regard in particular to the following documents:  
  
D7: US 4,533,098
  
- III. In a communication of 9 July 2021 in preparation for oral proceedings the Board gave a provisional opinion on the relevant issues.
  
- IV. Oral proceedings were held on 9 March 2022 in the form of a videoconference.
  
- V. The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.
  
- VI. The respondent (patent proprietor) requested that the appeal be dismissed and the patent be maintained as upheld, alternatively in the form of one of the auxiliary requests 1 to 4 filed with the reply to the grounds of appeal.

VII. The wording of Claim 1 as upheld reads as follows:

"An apparatus for changing a gas flow path (264) formed in a jet engine (102) by an inner cowl (316) and an outer cowl (318), said apparatus comprising: a chevron (322), the chevron having a base end (340) and a featured end (342), the featured end (342) narrower in width than the base end (340); a linear actuator (350) coupled to the chevron (322) and to the outer cowl (318) of the jet engine, wherein the chevron is movable by the linear actuator (350) forward or aft to change the position of the chevron (322) relative to the gas flow path (264); characterized in that:  
the linear actuator (350) has a rotor (352) and a stator (354); and  
the chevron (322) comprises a longitudinally extending slot (378) that is sized and configured to receive a component of the linear actuator (350) therein, wherein the rotor (352) is set into the slot (378), the stator (354) translatable along the rotor (352)."

VIII. The appellant argues as follows:

- Claim 1 lacks clarity in respect of the rotor and stator of the linear actuator.
- Claim 1 is based on an unallowable intermediate generalisation and thus extends beyond the content of the application as filed.
- Starting from D7 the skilled person would consider it obvious to provide the alternative embodiment of setting the rotor of the linear actuator in the slot instead of the stator as disclosed in D7.

IX. The respondent argues as follows:

- The skilled person can easily interpret the terms rotor and stator in the context of actuators.

- Amendments to Claim 1 only concern the relationship between the actuator on the chevron without need to specify its fixture.
- D7 discloses a thrust reverser and the skilled person would not obviously have adapted it to provide an actuator to translate a chevron.

### **Reasons for the Decision**

1. The appeal is admissible.
2. Clarity - Art. 84 EPC
  - 2.1 During the opposition procedure granted claim 1 has been amended by incorporating features from the description. These features concern the shape of the chevron, the linear actuator that comprises a rotor and stator, the slot which extends longitudinally and receives the rotor of the linear actuator and that the stator translates along the rotor. Since these amendments concern subsequent modifications of the granted claim , they may be examined for clarity under Article 84 EPC, see G 3/14 (OJ EPO 2015, 102).
  - 2.2 The appellant focuses on the feature concerning the linear actuator having a rotor and stator, which would not be supported by the description, thus contrary to Article 84 EPC. Furthermore, linear actuators such as a conventional hydraulic actuator do not have a rotor or stator. In a "ball nut" type of linear actuator, the screw rotates to translate the rod provided with the ball nut, however the rod is not static contrary to the normal understanding of a stator, therefore the terms rotor and stator are unclear and ambiguous in the present context.

2.2.1 In the context of a linear actuator the Board reads the terms *stator* and *rotor*, normally used to describe the main driving components of an electrical motor, as defining in analogous manner the driving components of a linear motor. A linear motor, which is per se well known in field, is effectively an electric motor that has had its stator and rotor unrolled to produce a linear force along its length. In that analogy the rotor is then that part that is driven to move along the longitudinal stator as stationary part. The Board thus tends to read these terms in a more limited sense than does the respondent proprietor as referring to such a linear motor.

2.2.2 This understanding is supported by the only example of a linear actuator described in the patent. In paragraph 0024 the linear actuator is "preferably an electromagnetic linear motor with a rotor that is slidably mounted with a stator". It is true that paragraph 0024 describes an embodiment, that of figure 3, not covered by the claims as upheld (as it does not include a slot). However, later on when paragraph 0032 describes the linear actuator of the embodiment of figures 7 to 10, which is covered by the claims as upheld, it uses the same terms *rotor* and *stator* to describe an arrangement that is very similar to that shown in figure 3. There the rotor 352 can be seen to slidably coupled to an elongate stator element 354, just as in figure 3 rotor 252 is slidably coupled to stator 254. To the skilled reader it is immediately clear that in the later passage the same type of electromagnetic linear motor is being described there also.

Thus claim 1 of the main request is both clear and supported by the description for the purpose of Article 84 EPC.

2.3 In its communication in preparation for oral proceedings under item 3.1 the Board gave the following provisional opinion on the remaining two further objections of lack of clarity raised by the appellant in their grounds:

*"The first two objections on clarity concern the use of relative dimensions "narrow width" or extension "longitudinal extending slot" or relative movement "translatable stator" without reference. In the Board's preliminary opinion, contextual reading of the claim allows a clear interpretation of its scope as concluded by the opposition division.*

*In the field of jet engines, chevrons are well known as saw toothed elements on the trailing edge of an exhaust nozzle (see for example Annex R1, abstract). In that context a chevron is understood as having a substantially triangular shape - in plane - having an apex at its downstream end that corresponds to the featured end defined in claim 1. Seen in a circumferential direction of the outer cowl to which the chevron is coupled by the linear actuator, the requirement that its featured end should have a narrower width than at its base end appears clear.*

*The slot provided in the chevron should have a longitudinal extension. Contextual reading requires the slot to receive a component of an actuator that according to the last feature of the preamble allows movement between forward and aft positions relative to the gas flow path. To construe "longitudinal" other*



*than along the forward and aft movement would not make much technical sense."*

As the appellant did not provide any further arguments on these particular objections, the Board does not see any reason to depart from its provisional assessment.

2.4 The Board thus confirms the opposition division's positive assessment on clarity pursuant Article 84 EPC.

3. Added subject-matter - Art. 123(2) EPC

3.1 Claim 1 as granted combines the features of claims 11 and 14 of the application as filed directed at an apparatus for changing the gas flow path formed between an inner and outer cowl of a jet engine. Those claims defined a chevron and a linear actuator that connects it to the engine's outer cowl, and specified that the chevron has a slot that receives a component of the linear actuator. The actuator of claim 1 as upheld adds further features of these components by further specifying the shape of the chevron, that the linear actuator comprises a rotor and stator, that the slot extends longitudinally and receives the rotor of the linear actuator and that the stator translates along the rotor.

3.2 The appellant essentially argues that these features have been isolated from a close structural and functional context including other features not included thus resulting in an unallowable intermediate generalisation. They more particularly take issue with the fact that the rotor as particular component of the linear actuator that is set into the slot, was disclosed in combination with the *flanges* and a *cavity* further described in paragraphs 032 and 033. In

particular, the flanges would be necessary to accommodate the rotor within the cavity, which encompasses the slot.

3.3 The slot was already defined in the characterising part of granted claim 1 to be sized and configured to receive a component of the linear actuator. As stated the claim now specifies that the linear actuator is effectively a linear motor with its rotor the component in question. That it is the rotor indisputably has a basis in paragraphs 0032 and 0034. However, the Board is unable to see any connection between the fact that actuator is a linear motor and the component its rotor, one of the two basic components of such a motor, and the particular way in which the rotor is accommodated within the slot. Whether that is via a flange or by other means does not affect the basic function of the linear motor or the rotor in this actuating arrangement, as the skilled person will immediately recognize. Similarly, that in paragraphs 0032 and 0033 the slot is a part of cavity, where, as the skilled person knows, a slot is already itself a cavity, may be of interest to the linguist, it does not convey any clear technical information regarding a close relationship with the use of a rotor or a linear motor. For the skilled person it suffices to know that it is the rotor and not the other part of the linear motor actuator, namely its stator, that is located in the slot.

3.4 The Board is thus unable to see in the mere identification of the rotor of a linear motor as the actuator component in the slot an unallowable intermediate generalization..

3.5 As concerns the other aspects that were brought against the amendments of claim 1 the Board gave the following provisional opinion in item 3.2 of its communication:

*"The shape of the chevron, in particular its "featured end narrower in width than its base end" derives from paragraph 030 of the published application. This feature concerns the standard shape of a chevron with a narrow tip as also apparent in all embodiments (first embodiment apparatus 200 , figure 2 to 6; last sentence of paragraph 021; second embodiment , figure 7 to 10; paragraph 029). No close structural or functional relationship is seen to exist between this standard aerodynamic tapering shape of a chevron and the further refinement detailed on page 11, lines 16-21 (paragraph 031 of the A-publication) of the chevron housing all components for its activation as submitted by the appellant. The normal tapering shape of a chevron serves to achieve the aerodynamic effect of flow mixture which is entirely distinct and independent from the means 200 or 300 by which it is actuated.*

*The slot has been further specified in the amended claim 1 as being longitudinally extending. This is implicit in the definition of a slot as "a narrow opening or groove" (Merriam Webster) and thus adds nothing to the claim."*

3.6 As the appellant did not provide any further arguments on these particular objections, the Board does not see any reason to depart from its provisional assessment.

3.7 The Board thus confirms the conclusion of the opposition division in respect of allowability of the intermediate generalisation, Article 123(2) EPC.

4. Review of admission of D7 by the opposition division.

4.1 Concerning the respondent's request not to admit D7 into the proceedings they referred to their written submissions. In item 3.3 of its communication the Board made the following observations in relation to this procedural request:

*"D7 was admitted into the proceedings and successfully cited against inventive step for claim 1 as granted, point 16 of the decision. .... The Board sees no cogent reason why it should not admit evidence on which the valid part of the decision is based, or even how, under what legal provision, it could do so See CLBA, V.A. 3.5.4.*

*Apart from this the division appears to have exercised its discretion on the basis of prima facie relevance and thus according to the correct principles, and after having heard the parties, that is following due process."*

4.2 As the respondent refrained from further comment the Board confirms its position not to overturn the division's decision to admit D7.

5. Inventive step

5.1 D7 discloses a translatable cowling for changing the gas flow path formed in a jet engine. The annular cowling 2 is movable by a linear actuator 121 coupled to an outer cowl of the engine (col. 4, lines 32-35). D7 more particularly concerns the attachment of a yoke to the laminated material of the composite movable cowling for improving a thrust reverser (col 2, lines 12-19). It is undisputed that D7 does not disclose chevrons for

noise reduction purposes as in the patent (paragraph 005, last sentence).

In D7 the channel 91D provided between two plates 60,62 in figure 5 (col 3, lines 45-46), which the appellant identifies as the longitudinal slot, is a passage wherein the end of the actuator rod 121 is connected to the yoke 115, which forms the attachment part within the recessed portion of the cowling (col 4, lines 20-26). The active part of the actuator is explained (col.4, lines 32 onwards) to include a ball nut on which the actuator rod is attached and is driven by a threaded shaft, all these components located on the engine side. Although not shown in figure 5, the threaded shaft of each of the actuators 10A-C is nevertheless visible in figure 1 on the right hand side of the aircraft engine nacelle.

- 5.2 Assuming that the end of the actuator rod is the stator, the apparatus defined in claim 1 differs from the disclosure of D7 by the following features:
- a chevron having a base end and a featured end narrower in width than the base end;
  - the linear actuator is a linear motor and is coupled to the chevron and to the outer cowl of the jet engine,
  - its rotor is set into a slot of the chevron.

- 5.3 Concerning the first of these features, the Board agrees with the opposition division that providing a chevron on the cowling of D7 would per se have been an obvious measure for a skilled person intent to reduce noise, as illustrated by D3. The Board adds that similarly, the use of a linear motor per se as actuator is common in the field.

5.4 However, it is the combination of chevron and actuator that is seen to go beyond routine skill of the skilled person, an aeronautical engineer.

As regards the way the linear actuator is attached to the chevron, the Board disagrees that this would only concern which part of the linear actuator, rotor or stator is set to the slot of the chevron and thus a matter of a simple choice between two alternatives. Rather, the claim is more specific and requires that a chevron is coupled to the outer cowl using the linear actuator. This is because D7 does not disclose a chevron and therefore does also not provide for a slot within a chevron nor a rotor of a linear actuator set therein. Therefore, rather than providing an alternative construction as suggested by the appellant, the objective technical problem should also take into account the further effect of moving a chevron with respect to the aft cowl and as a consequence also relative to the gas flow path between the inner and outer cowl of the engine. Making a chevron translatable with respect to an aft cowl of the engine further improves acoustic attenuation (paragraph 006 last sentence), and the objective technical problem may thus be formulated as providing a noise reduction device with optimised or enhanced noise reduction properties.

5.5 As stated earlier seeking to improve the thrust reverser of D7 with a noise reduction device the skilled person would obviously consider the use of chevrons at the trailing edge of the aft cowl 2. However, on the basis of the prior art cited, the Board is unconvinced that they would then also as a matter of obviousness realize the chevron so as to be actuatable to translate with respect to the thrust reverser of D7,

let alone that they would do so by setting the rotor of this linear actuator into a slot of the chevron. As noted D3 only teaches attachment of chevrons directly in fixed manner to the cowling. The patent itself in paragraph 0003, where it discusses the prior art, mentions the known use of adjustable chevrons in variable area fan nozzles (VAFN), e.g. by means of hydraulic actuation or using shape memory alloys. However there is no suggestion there of their use in connection with the cowling of a thrust reverser as in D7.

5.6 It would thus not be enough to simply invert the position of the threaded rod of the actuators 10A-C in D7 so as to couple them into the slot 91D of the cowl 2, provided in obvious manner with chevrons, as submitted by the appellant. The result would still be a cowl with fixed (immovable) chevrons. As will be evident from the above, the Board reads the claim as requiring that the chevron be actuatable with respect to the outer cowl. This follows from a reasonable reading of the feature of a linear actuator coupled to the chevron and to the outer cowl.

5.7 The Board thus confirms the opposition division's positive assessment that the subject-matter of claim 1 as upheld fulfils the requirements of inventive step, Article 52(1) with Article 56 EPC.

6. Neither of the appeal's challenges to the findings of the decision under appeal succeed and the Board thus confirms the opposition division's conclusion that the patent as upheld meets the requirements of the EPC and can therefore be maintained in amended form according to the fourth auxiliary request of the impugned decision, in accordance with Article 101(3) (a) EPC.

**Order**

**For these reasons it is decided that:**

**The appeal is dismissed.**

The Registrar:

The Chairman:



B.Brückner

A. de Vries

Decision electronically authenticated