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**Datasheet for the decision
of 14 June 2018**

Case Number: T 1582/15 - 3.2.01

Application Number: 07861210.8

Publication Number: 1993907

IPC: B64C25/60, F16F9/36

Language of the proceedings: EN

Title of invention:

AIRCRAFT SHOCK STRUT HAVING IMPROVED CYLINDER AND BEARINGS

Patent Proprietor:

Goodrich Corporation

Opponent:

Messier-Bugatti-Dowty

Headword:

Relevant legal provisions:

EPC Art. 56

Keyword:

inventive step (yes)

Decisions cited:

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 1582/15 - 3.2.01

D E C I S I O N
of Technical Board of Appeal 3.2.01
of 14 June 2018

Appellant: Messier-Bugatti-Dowty
(Opponent) Inovel Parc Sud
78140 Vélizy-Villacoublay (FR)

Representative: Parzy, Benjamin Alain
Cabinet Boettcher
16, rue Médéric
75017 Paris (FR)

Respondent: Goodrich Corporation
(Patent Proprietor) Four Coliseum Centre
2730 West Tyvola Road
Charlotte, NC 28217-4578 (US)

Representative: Dehns
St. Brides House
10 Salisbury Square
London EC4Y 8JD (GB)

Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 22 June 2015
rejecting the opposition filed against European
patent No. 1993907 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman G. Pricolo
Members: C. Narcisi
P. Guntz

Summary of Facts and Submissions

I. The opposition against European patent No. 1 993 907 was rejected by the decision of the Opposition Division posted on 22 June 2015. Against the decision an appeal was lodged by the Opponent on 11 August 2015 and the appeal fee was paid. The statement of grounds of appeal was filed on 30 October 2015.

II. Oral proceedings took place on 14 June 2018. The Appellant (Opponent) requested that the decision under appeal be set aside and that the patent be revoked. The Respondent (Patentee) requested that the decision be set aside and that the patent be maintained in amended form on the basis of the main (and sole) request as filed during the oral proceedings on 14 June 2018.

III. Claim 1 reads as follows:

"An aircraft shock strut (12) comprising:
a titanium cylinder (32) having an inner surface (34) of bare titanium;
a piston (30) telescopically movable within the cylinder (32); and a bearing (40; 50) on the piston (30), the bearing (40;50) having a non-metallic bearing surface providing sliding engagement with the inner surface (34) of the cylinder (32), wherein the bearing surface is formed by a polymerized imide material or a polyketone thermoplastic material."

Claim 10 reads as follows:

"A method of reducing weight of an aircraft landing gear including at least one shock strut (12), the at least one shock strut including a cylinder (32) and a

piston (30) telescopically movable within the cylinder (32), the method comprising the steps of: providing a titanium cylinder (32) having an inner surface (34) of bare titanium; and mounting a bearing (40; 50) to the piston (30), the bearing (40; 50) having a non-metallic bearing surface providing sliding engagement with an inner surface (34) of the cylinder (32), wherein the bearing surface is formed by a polymerized imide material or a polyketone thermoplastic material."

IV. The Appellant's arguments may be summarized as follows:

The subject-matter of claim 1 lacks an inventive step over document E1 (US-B1-6 676 076) in view of further documents E9 (US-A-5 338 827) and E122 (WO-A1-03/103954). E1 discloses an aircraft shock strut including all the features of claim 1, except for the feature reading "the bearing (40;50) having a non-metallic bearing surface providing sliding engagement with the inner surface (34) of the cylinder (32), wherein the bearing surface is formed by a polymerized imide material or a polyketone thermoplastic material" (hereinafter designated as feature (i)). In particular, the feature reading "a titanium cylinder (32) having an inner surface (34) of bare titanium" is known from E1, for E1 discloses a titanium cylinder (E1, column 4, lines 18-21) implicitly including both a coated or an uncoated (i.e. "bare") inner surface. Starting from E1 the skilled person would face the technical problem of reducing material wear and friction resulting at the interface between the bearing surface and the cylinder's inner titanium surface. Looking for a solution to this problem the skilled

person would retrieve and retain document E9, disclosing that polymerized imide materials are apt for use at high temperatures in jet engine cowls and ducts, as well as in aircraft frames, because of their advantageous load bearing characteristics (see E9, column 1, lines 20-27; column 12, lines 30-35). Thus, the skilled person would use polymerized imide materials having a low friction coefficient in an aircraft shock strut as known from E1 and would thus arrive at the subject-matter of claim 1 in an obvious manner. In a similar way the skilled person would retain document E122 disclosing polyketone (PEEK) as a low friction material apt for use as a bearing material, particularly in an aircraft shock strut assembly according to E1. Therefore both alternatives implied by aforesaid feature (i) would be obvious for the skilled person in view of E9 or E122.

The subject-matter of claim 1 lacks an inventive step over the alleged public prior use demonstrated by documents E101 (Plan "A320-200 (Enhanced) Main Landing Gear Assembly 201540100, issue 1"), E102 ("Drawing Office Works Instruction 97E252"), E103 ("Final Modification Approval Form (c) AC12144"), 104 ("Final Modification Approval Form (c) AC12492"), E105 (Extract from "A320 Main Landing Gear Leg Component Maintenance Manual 32-12-25"), E106 ("Premier extrait d'une liste de P/N"), E107 (Drawing "Rationalised Main Fitting Sub-Assembly A320 Main Landing Gear 201540205, issue 11"), E108 (Drawing "Rationalised main fitting Final Machining. A320 Main Landing Gear 201540300, issue 28"), E109 (Drawing "Main Fitting Forging 201540500, issue 6", E110 ("Deuxième extrait d'une liste de P/N") and E111 ("Drawing 201160637"). Indeed, the subject-matter of claim 1 would be obvious for the skilled person in view of E101-E111 in conjunction with E9 or

E122. The aircraft shock strut disclosed by the alleged public prior use differs from the claimed subject-matter only in that the cylinder's inner surface consists of bare steel (by contrast to bare titanium as claimed) and in that the non-metallic bearing surface consists of Turcite 255 (instead of polymerized imide material or polyketone as claimed). The resulting objective technical problem would thus reside in reducing the cylinder's weight as well as the friction and wear at the interface between the bearing surface and the cylinder's inner surface. Consequently, it would be obvious for the skilled person to use a bare titanium cylinder replacing the bare steel cylinder, given that titanium is a lighter metallic material known to be commonly used in aircrafts and particularly in aircraft shock struts too, as shown e.g. by E1. Secondly, as already laid out hereinabove, E9 and E122 respectively disclose that polymerized imide and polyketone are both well apt for use as bearing materials in an aircraft shock strut and the skilled person would realize that these materials provide an adequate alternative solution to the use of Turcite 255. In conclusion, the skilled person would arrive at the subject-matter of claim 1 without an inventive step being involved.

For reasons of clarity lines 52-55 in paragraph [0027] (starting from "however...") of the patent specification (hereinafter designated as EP-B) should be deleted and claim 6 should depend only on claim 5. The Appellant stated that no other objections were submitted against the sole request as filed during the oral proceedings before the Board.

V. The Respondent's arguments may be summarized as follows:

The subject-matter of claim 1 is inventive over E1, in view of further documents E9 and E122, as well as over the alleged public prior use (supported by documents E101-E111), in view of E9 and E122.

E1 discloses an aircraft shock strut including merely a titanium cylinder and not a cylinder having an inner surface of bare titanium. This is neither explicitly nor implicitly disclosed in E1. Indeed, it is well known in the art (see for instance E7 (Conference Proceedings - paper by P Jacquot "Amélioration de propriétés tribologiques d'alliages de titane par les procédés PVD et Triniton")) that a bearing or sliding surface of bare titanium behaves very poorly due to high wear and friction values, such that only coated titanium bearing or sliding surfaces are used in the prior art. For these same reasons the skilled person would not replace the bare steel cylinder's inner surface of E101-E111 with an inner surface of bare titanium. Further, no indication or suggestion is to be found in E9 or E122 that the use of bare titanium in conjunction with polymerized imide or polyketone material would reduce friction and wear, which was actually found only by the present invention. Finally, there is also no indication or suggestion in E9 or E122 that polymerized imide or polyketone material would be apt for use in a bearing surface of an aircraft shock strut. For these reasons both lines of argument (starting from E1 or from E101-E111) against inventive step must fail.

Reasons for the Decision

1. The appeal is admissible.
2. The subject-matter of claim 1 is inventive over E1, in view of further documents E9 and E122, and over the alleged public prior use (as supported by E101-E111) in view of E9 and E122.

As to E1, this document does not disclose aforementioned feature (i) and likewise a bare titanium cylinder inner surface. Contrary to the Appellant's view, the disclosure of E1 (see column 4, lines 12-23) merely generally indicates that the cylinder's housing is made of high-strength materials such as steel, which materials may also "include aluminium and titanium". E1 dealing mainly with a specific structure of an aircraft shock strut, no particular emphasis is placed on details concerning specific materials. However, due to considerably high forces (and related friction and wear) acting on the shock strut upon landing (see also E1, cited passage), the skilled person knows that the materials at the interface between the piston's bearing surface and the cylinder must be carefully chosen. The skilled person starting from E1 knows that (according to common knowledge prior to the filing date of the present invention) bare titanium has a poor or even extremely poor wear resistance and exhibits high friction values when used (as a bearing surface) in sliding contact with other materials (see e.g. E7, page 4, point 5) in conjunction with high loads. No convincing and sufficient evidence to the contrary was provided by the Appellant during opposition or appeal proceedings.

Hence, also in view of common general knowledge prior to the filing date of the invention, E1 has to be construed as not disclosing a bare titanium cylinder's inner surface, the skilled person rather considering the cylinder's inner surface to be coated with an appropriate material (see e.g. E7, page 4, point 6), at least for applications in aircraft shock struts where high loads are usually met.

Further, in view of the above reasons, the skilled person starting from the aircraft's shock strut of E1 would anyway not contemplate in an obvious manner to use bare titanium as the cylinder's inner surface in said shock strut.

For the same reasons as above, starting from the alleged public prior use based on E101-E111 the skilled person would not have any incentive to replace the bare steel inner surface of the cylinder with bare titanium.

In addition, E9 and E122 do not include any hint or suggestion to use polymerized imide or polyketone materials as surface bearings in aircraft shock struts. Moreover, there is absolutely no indication in E9 or E122 that polymerized imide or polyketone materials constituting the bearing surface would produce low friction values and would result in low wear when used in conjunction with a bare titanium inner cylinder surface.

In conclusion, the skilled person starting from E1 or from the alleged public prior use would not arrive in an obvious manner in view of the aforementioned prior art (e.g. E9 or E122) at the subject-matter of claim 1 (Article 56 EPC).

For the stated reasons the subject-matter of method claim 10 (including features equivalent to those of claim 1) meets the requirements of Article 56 EPC.

3. The adaptation of the description of EP-B complies with the requirements of Article 84 EPC and Article 123(2) EPC. In particular, the Appellant's objections are considered to be unfounded, for the terms of claim 1 clearly define the bearing surface on the piston, regardless of whether this is a lower or an upper bearing. The terms "lower" and "upper" are merely used to refer to the relative position in the drawings (see EP-B, [0018]).

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 in amended form on the basis of the following documents:
 - claims 1 to 13,
 - description columns 1 to 9 with insertions A, B and C,
 - figures 1 to 7,

all as in the sole request, submitted during oral proceedings.

The Registrar:

The Chairman:



K. Boelicke

G. Pricolo

Decision electronically authenticated