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**Datasheet for the decision
of 16 December 2022**

Case Number: T 0427/20 - 3.2.04

Application Number: 12160235.3

Publication Number: 2500551

IPC: F02C9/26, F02C7/236

Language of the proceedings: EN

Title of invention:

Fuel flow control system and method for controlling two positive displacement pumps

Patent Proprietor:

Hamilton Sundstrand Corporation

Opponent:

Safran Aircraft Engines

Headword:

Relevant legal provisions:

EPC Art. 123(2), 84

RPBA Art. 13(1)

Keyword:

Amendments - intermediate generalisation
Claims - clarity after amendment (no) - interpretation of
ambiguous terms
Late-filed auxiliary request - admitted (yes)
Requests violating the principle of the prohibition of
reformatio in peius (yes) - not admitted

Decisions cited:

G 0003/14

Catchword:



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Case Number: T 0427/20 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 16 December 2022

Appellant: Safran Aircraft Engines
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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
20 December 2019 concerning maintenance of the
European Patent No. 2500551 in amended form.**

Composition of the Board:

Chairman A. de Vries
Members: S. Hillebrand
T. Bokor

Summary of Facts and Submissions

I. The appeal was filed by the Opponent against the interlocutory decision of the Opposition Division finding that the patent in suit in an amended form according to an auxiliary request 1 (now main request) met the requirements of the EPC.

In particular, the Opposition Division held that the subject-matter of claim 1 did not extend beyond the content of the application as filed and that claim 1 was clear in the sense of Article 84 EPC.

II. In a communication pursuant to Rule 15(1) RPBA gave a preliminary opinion on the relevant issues.

III. On 16 December 2022 oral proceedings were held before the Board in the form of a videoconference with both parties attending remotely.

IV. The Appellant (Opponent) requests that the decision under appeal be set aside, and that the European patent No. 2500551 be revoked. They further request the reimbursement of the appeal fee.

The Respondent (Proprietor) requests that the appeal be dismissed, i.e. that the patent be maintained as upheld by the Opposition Division. Alternatively, they request that the decision under appeal should be set aside and the patent be maintained with one of auxiliary requests 1 to 5, as renumbered with letter dated 1 November 2022, where auxiliary requests 1, 3 and 4 were filed as third auxiliary request, main request and first auxiliary request, respectively, with letter dated 28 August 2020, and auxiliary requests 2 and 5 were filed

as fifth and fourth auxiliary requests, respectively, with letter dated 26 April 2021.

- V. Independent claim 1 of the main request (as upheld) reads as follows (amendments with regard to the granted version highlighted by the Board):
1. "A fuel flow system (10) for a gas turbine engine, the system comprising:
nozzles (46) of a combustion chamber;
a first pump (20) connected to an actuator (48) and the nozzles;
a second pump (38) connected to the ~~actuator~~ nozzles
and arranged in parallel with the first pump;
a metering valve (24) disposed downstream of the first pump and upstream of the nozzles;
an actuator (48) connected to the first pump downstream of the first pump and upstream of the metering valve,
the actuator being configured to receive high pressure fluid from the first pump and to return low pressure fluid upstream of inlets of the first pump and the second pump;
a bypass loop (12e) that recycles fuel flow from the first pump and the second pump to the inlets of the first pump and second pump;
an integrating bypass valve (28) having a first window (28a) that regulates fuel from the first pump through the bypass loop and a second window (28b) that regulates fuel from the second pump through the bypass loop, wherein the integrating bypass valve (28) is a half area servo that has a stepped diameter and that does not include a spring setting a regulating pressure; and
a pilot valve (30) that is configured to sense a pressure differential across the metering valve and, in response, to control~~controls~~ a size of the first window and a size of the second window of the

integrating bypass valve by regulating a modulated pressure on one side of the integrating bypass valve using a pressure control signal (36), wherein the integrating bypass valve is in force balance when the pressure control signal is halfway between a high pressure (Pf) and a low pressure (Pd) by the area ratio of the integrating bypass valve, the high pressure being taken from a location downstream of the first pump and upstream of the metering valve and the low pressure being taken from a location upstream of the first pump and the second pump."

Claim 1 of auxiliary request 1 differs i.a. from claim 1 according to the main request in comprising the following features (amendments with regard to the main request highlighted by the Board):

"...an actuator (48) ... configured to receive high pressure fluid from the first pump and to return low pressure fluid upstream of inlets of the first pump and the second pump;

a minimum pressure shut-off valve (26) configured to regulate a discharge pressure of the first pump above an inlet pressure of the first pump;

a bypass loop (12e)...

... wherein the integrating bypass valve (28) is a half area servo that has a stepped diameter ~~and that does not include a spring setting a regulating pressure;~~ and a pilot valve (30) that is configured to sense a pressure differential across the metering valve using an upstream pressure signal line (32a) and a downstream pressure signal line (32b) and, in response, to control a size of the first window and a size of the second window of the integrating bypass valve by regulating a modulated pressure on one side of the integrating bypass valve using a pressure control signal (36), wherein the first window and the second window are

mechanically linked,
wherein the pilot valve comprises a preload setting a
regulating pressure of the integrating bypass valve,
and the integrating bypass valve does not include a
spring setting the regulated pressure;
wherein the integrating bypass valve is in force
balance ...".

Claim 1 of auxiliary request 2 differs i.a. from claim
1 according to the main request in comprising the
features (amendments with regard to the main request
highlighted by the Board):

"... an actuator (48) ... configured to receive high
pressure fluid from the first pump and to return low
pressure fluid upstream of inlets of the first pump and
the second pump;

a minimum pressure shut-off valve (26) configured to
regulate a discharge pressure of the first pump above
an inlet pressure of the first pump to assure positive
operation of the actuator (48) against its design load;
a bypass loop (12e)...

... wherein the integrating bypass valve (28) is a half
area servo that has a stepped diameter ~~and does not~~
~~include a spring setting the regulated pressure;~~

and a pilot valve (30) that is configured to sense a
pressure differential across the metering valve using
an upstream pressure signal line (32a) and a downstream
pressure signal line (32b) and, in response, to control
a size of the first window and a size of the second
window of the integrating bypass valve by regulating a
modulated pressure on one side of the integrating
bypass valve using a pressure control signal (36),
wherein the first window and the second window are
mechanically linked,
wherein a regulated pressure of the integrating bypass
valve is set by a preload on the pilot valve, and the

integrating bypass valve does not include a spring setting the regulated pressure;
wherein the integrating bypass valve is in force balance ...".

Claim 1 of auxiliary requests 3 to 5 differs i.a. from claim 1 according to the main request in that the disclaimer is (completely) deleted (amendments with regard to the main request highlighted by the Board):
"... wherein the integrating bypass valve (28) is a half area servo that has a stepped diameter ~~and does not include a spring setting the regulated pressure;~~
and a pilot valve (30)..."

VI. The Appellant's arguments can be summarised as follows:
Auxiliary requests 1 and 2 should not be admitted because they should have been filed already during opposition proceedings and were not prima facie allowable.

The subject-matter of claim 1 according to the main request and auxiliary request 1 extended beyond the content of the application as filed due to an intermediate generalisation. Claim 1 of auxiliary request 2 was not clear. Auxiliary requests 3 to 5 were inadmissible because they led to a reformatio in peius. The appeal fee should be reimbursed because the decision under appeal lacked reasoning, and this constituted a substantive procedural violation.

The Respondent's arguments can be summarised as follows:

Claim 1 according to the main request and auxiliary requests 1 and 2 complied with the provisions of the EPC, in particular with regard to added subject-matter and clarity. The skilled person had no difficulties to clearly understand and identify all claimed features

despite some minor inconsistencies in the terminology caused by literal citations from the original disclosure. Auxiliary requests 3 to 5 were maintained as a precautionary measure for the case that the Board would deviate from its provisional opinion with regard to the disclaimer as expressed in its communication.

Reasons for the Decision

1. The appeal is admissible.

2. The patent and its technical background

The patent deals with fuel systems for gas turbine engines, which are also used for cooling hot lubricants such as oil, see paragraphs [0001] and [0002].

The patent, see the independent claims and the summary of the invention in paragraph [0003], focuses on a pilot valve 30 (pressure regulating or control valve 30 in the description) and an integrating bypass valve 26, which adapt the amount of fuel delivered from a main (first or cruise) pump 20 and from a parallel supplementing (second or idling) pump 38 to the nozzles in a combustion chamber and/or a bypass loop leading back to the inlets of both pumps according to engine needs in different operation phases.

As described in the last paragraphs of the patent, the aim is to accurately control and maintain a target pressure differential across a metering valve (MV) 26, which meters fuel to the nozzles, by regulating a pressure upstream of the MV 26. This pressure is in turn controlled by adjusting metering windows in the integrating bypass valve establishing fluid communication between the pumps and the bypass loop, respectively. The size of the metering windows depends on the position of the integrating bypass valve 28,

which is adjusted by a pressure control signal 36 applied by the pilot valve 30 in response to the pressure differential sensed across the MV 26. According to claim 1 as upheld, the integrating bypass valve is a half area servo and in force balance, when a certain pressure control signal is applied to one side of it due to the area ratio and without relying on a spring for setting the regulating pressure.

3. **Main request and auxiliary request 1 - added subject-matter**

3.1 The actuator 48 already mentioned in original claim 1 as being connected to the first pump 20 has been further defined in claim 1 of both the main request and auxiliary request 1 as being "*configured to receive high pressure fluid from the first pump*". This is neither implicit from the wording of original claim 1, nor from that of original independent claim 8, which did not specify the level of pressure produced by the first pump. Even if they defined the first pump as *providing* high pressure fluid, this would not directly and unambiguously lead to the conclusion that the actuator is generally *configured to receive* high pressure fluid, i.e. to be operated with high pressure fluid and to be thus of high pressure fluid type. Since the connection between first pump and actuator is not limited to a direct one in original claims 1 and 8, it is in principle possible that the fluid exiting the first pump is conditioned to a specific lower working pressure of the actuator, e.g. by a pressure relief valve in the flow path between first pump and actuator.

3.2 Paragraph [0009] of the application discloses a "cruise" pump that increases the pressure of fuel "sufficiently to satisfy the load requirements of the

actuators 48". Apart from the fact that a *cruise* pump is not part of the claimed fuel flow system, this passage is also silent on the pressure level actually received by the actuators.

3.3 The only basis of disclosure for the actuator being of the high pressure fluid type is therefore paragraph [0010] of the original application, in particular its first sentence: "The actuators 48 *can be* high pressure fluid actuators..". The penultimate sentence of this paragraph describes where in this case the high pressure fluid for the actuators comes from and provides a basis for the second part "from the first pump" of the above actuator feature in claim 1. This feature can thus be seen to stem exclusively from paragraph [0010], first and penultimate sentences of the application as filed.

3.4 The question therefore arises whether the text between the first and penultimate sentences can be omitted when introducing into claim 1 features from surrounding parts of the passage. The middle part deals with a minimum pressure and shut off valve MPSOV (the pressure values in the following sentence being explicitly said to be an "example") and explains its specific function. One purpose of an MPSOV located downstream of a fuel pump in a fuel system is to assure that the pressure downstream of the pump is always at least at a minimum pressure above its inlet pressure. The first part of that function of the MPSOV in paragraph [0010], which relates to the cruise pump 20, is therefore understood to apply generally to the operation of an MPSOV located downstream of the first (cruise) pump, independent of the particular pressure regime in connection to actuators.

However, the second part of the MPSOV's function is read in the context of the high pressure fluid actuators discussed in paragraph [0010]. It specifically relates to the operation of these actuators by not merely regulating to a discharge pressure at any small difference above inlet pressure, but in such way as to "assure the positive operation of the actuators 48 against their design load". It is this functional relationship which in paragraph [0010] links the presence of high pressure fuel actuators in the fuel flow system inextricably to the presence of a MPSOV, the latter being required for assuring the proper operation of these actuators.

3.5 Since claim 1 of neither the main request nor the auxiliary request 1 includes the MPSOV together with its functional feature "to assure the positive operation of the actuator against its design loads", its subject-matter extends beyond the content of the application as originally filed, Article 123(2) EPC.

4. **Auxiliary request 2 - admission**

4.1 Auxiliary request 2 corresponds to former fifth auxiliary request, which had not been filed together with the Respondent's reply to the appeal, but with letter of 26 April 2021 in reply to the comments made by the Appellant on auxiliary request 1 (former third auxiliary request). Its admission to the appeal proceedings is therefore subject to the discretion of the Board under Article 13(1) RPBA.

4.2 In section VI of their appeal brief, the Appellant reiterated a number of objections under Article 123(2) EPC, which the Opposition Division had not shared: the absence of the features check valve, MPSOV, pressure

signal lines, preload in the independent claims, which would lead to intermediate generalisations. In auxiliary request 1, the Respondent dealt with each one of the objections by introducing corresponding limiting features in the independent claims.

According to section VI of the Appellant's letter of 2 October 2020, they considered some of these amendments made with regard to the features MPSOV and preload as insufficient to address those objections and made clear which wording was in their opinion the only one supported by the original disclosure (penultimate paragraph of page 11 to first paragraph of page 12). In auxiliary request 2, the Respondent then complemented and corrected both claim amendments (MPSOV and preload) as suggested by the Appellant. These further amendments can thus be seen as a reaction to refined objections made in the Appellant's subsequent reply and are considered to be justified thereby.

4.3 Moreover, the Board does not consider an admission of auxiliary request 2 to be detrimental to procedural economy. The legal and factual framework of the appeal has not changed by filing auxiliary request 2. Added subject-matter and clarity of the particular amendments concerned had been an issue before. The changes made in the independent claims are also minor and not complex. They address the remaining objections and represent fair attempts to overcome them. Compared to auxiliary request 1, the Board is satisfied that the intermediate generalisation with regard to the feature MPSOV (see point 3, above) has been removed from claim 1. Finally, it is not immediately apparent to the Board from the submissions of the Appellant that the further amendment to claim 1 introduces a lack of clarity in regard of the terms "regulated" and "regulating", at

least not to such an extent that the skilled person would have difficulties in understanding the invention. Whether that is so can only be established by hearing the detailed arguments of both parties, see point 5.

4.4 For the above reasons, the Board decided to admit auxiliary request 2 under Article 13(1) RPBA.

5. **Auxiliary request 2 - clarity**

5.1 In a gas turbine fuel flow system, the pressure differential across a metering valve has to be kept at a nominal value or pressure setting in order to always deliver an amount of fuel to the engine, which is appropriate for the engine load or flight mode (e.g. at take-off or cruise). Changing engine needs lead to a pressure change downstream of the metering valve, which has to be compensated by changing the pressure of the fuel upstream of the metering valve in order to (re-)establish the nominal pressure differential or setting. These facts follow from basic considerations of the skilled person. In the patent, they are described in paragraphs [0002] and [0011].

5.2 According to claim 1, a pilot valve (30) senses an actual pressure differential across the metering valve by receiving a pressure upstream and a pressure downstream of the metering valve. In response it *regulates a modulated pressure* on one side of the integrating bypass valve by applying a *pressure control signal*. There is thus a *regulated pressure* between pilot valve and integrating bypass valve. Claim 1 goes on to state that "a *regulated pressure* of the integrating bypass valve is set by a *preload* on the pilot valve, and the integrating bypass valve does not include a spring *setting the regulating pressure*".

In the light of the previous features of claim 1, a *regulated pressure* of the integrating bypass valve set by a preload can be understood as being the *modulated pressure*, which depends on the sensed *pressure differential* causing the *preload* on the pilot valve. Read in combination with the following features, it appears, however, that the *preload* on the pilot valve replaces the function of a *spring* within the integrating bypass valve, which would otherwise set the regulating pressure, i.e. the upstream pressure establishing the nominal pressure differential across the metering valve. In that sense, the *preload* could also be provided by a *spring* in the pilot valve, and "a *regulated pressure*" would be the same as "the *regulating pressure*", i.e. only in this second case the terms would be synonymous, as argued by the Respondent. Rearranging the claim features for presenting the newly introduced terms "regulated pressure" and "preload" in the above order led therefore to ambiguity with regard to their meaning: The "regulated pressure" might either correspond to the "modulated pressure" or to the "regulating pressure", the "preload" then either to the sensed "pressure differential across the metering valve" or to a spring in the pilot valve.

However, not only the order of features, but also the chosen formulation "a regulated pressure of the integrating bypass valve" (emphasis by the Board) casts doubt on the meaning of the added term "regulated pressure". It is not clear whether this formulation has to be understood as "a regulated pressure acting on the integrating bypass valve", such as the modulated pressure and the pressure control signal, or as "a pressure regulated by the integrating bypass valve",

such as the regulating pressure, i.e. its output.

- 5.3 According to the Respondent it would be clear to the skilled person reading the claim in the light of the description that only the second interpretation was valid, as the terms "regulated pressure" and "regulating pressure" were interchangeably employed throughout the original application and the patent specification.

The Board notes that Article 84 EPC normally requires the claim wording to be clear in itself. It may be that in opposition or in a following appeal a granted claim may need to be interpreted in the light of the description to resolve a lack of clarity (not an opposition ground under Article 100 EPC), cf. CLBA, 10th edition, 2022, II.A.6.3.3. However, this does not apply to subsequent amendments, which may be examined for clarity insofar as a lack of clarity arises from the amendment itself, as clarified in G 3/14. In the Board's view this means that a subsequent amendment must be clear in its own right. Thus if the newly added feature "the regulated pressure of the integrating bypass valve" can not be understood without consulting the description, this would rather be an indication of the lacking clarity.

However, even consulting the description does not help in resolving the above clarity problem. First of all, the statement in paragraph [0025] of the patent specification according to which "the *regulated pressure* is set by the preload on" pilot valve 30 is made for the pressure regulating system. This system is introduced in preceding paragraph [0024] as comprising the pilot valve 30 in conjunction with the integrating bypass valve 28. For the system as a whole the

statement thus refers to the overall "output and input pressures" of the system. In claim 1, the corresponding feature relates, however, to the integrating bypass valve alone. Whilst the integrating bypass valve is that part of the system, which "finally" provides the regulated output pressure, it is at the same time subjected to an internal system pressure regulated by the pilot valve 30, which is accordingly called "pressure regulating valve 30" in paragraph [0025]. Because the terms "regulate" and "regulating" are thus employed in the description not only for the pressure downstream of the integrating bypass valve, but also for the pressure upstream of it, it still remains unclear which of either is meant by "the regulated pressure of the integrating bypass valve" in claim 1.

5.4 Finally, the Board adds that the way in which the pilot valve in cooperation with the integrating bypass valve controls the pressure differential across the metering valve is presented as a central aspect of the invention. It is important for a proper understanding of this aspect and thus of the invention defined by the claim that the terms used to define this aspect are clear.

5.5 Claim 1 of auxiliary request 2 has thus been amended so that it is not clear in the sense of Article 84 EPC.

6. **Auxiliary requests 3 to 5**

6.1 The disclaiming feature "does not comprise a spring setting a regulating pressure" of claim 1 as upheld was deleted from claim 1 of auxiliary requests 3 to 5. In its communication, the Board considered these requests therefore inadmissible for the following reasons:

"According to established case law, the non-appealing Proprietor is primarily restricted on appeal to defending the claims as maintained by the Opposition Division, a "reformatio in peius" to the detriment of the Opponent as sole Appellant being prohibited (CLBA 2019, V.A.3.1). One exception to this principle is set out in G1/99 (see CLBA V.A.3.1.8) and concerns an inadmissible amendment to a claim held allowable by the Opposition Division in its interlocutory decision. In that case, the non appealing Proprietor may be allowed to file requests that add originally disclosed features which limit the scope of the patent as maintained; if that is not possible, then amending the claim to introduce originally disclosed features that extend the scope of the patent as maintained but within the limits of Article 123(3) EPC; and only if that is also not possible to delete the inadmissible amendment but within the limits of Art 123(3) EPC.

In the present case, feature G.iv ("[half area servo] does not include a spring ...") was added to claim 1, and held allowable in opposition. As indicated below, the Board presently agrees with the findings of the Opposition Division with regard to the allowability of the disclaiming feature. Consequently, the exception would not apply and the requests concerned would not be admissible.

Moreover, it has not been convincingly demonstrated that the feature G.iv, if held inadmissible by the Board, could only be amended by its deletion, because adding other originally disclosed features would not be possible, as prescribed by G1/99."

- 6.2 In their reply of 1 November 2022, the Respondent did not challenge the provisional opinion of the Board, but demoted those requests, in the independent claims of

which the disclaimer had been deleted, to the lowest ranking auxiliary requests 3 and 5 for the case that the Board changed its provisional opinion during oral proceedings. As none of the parties wished to comment on the issue, the Board had no reason to change its preliminary opinion, and the Board decided not to admit auxiliary requests 3 to 5.

7. **Reimbursement of appeal fee**

7.1 In point 5 of its communication, the Board had expressed the following preliminary opinion with regard to the corresponding request made by the Appellant:

"The Appellant argues that the Opposition Division did not take into account a clarity objection with regard to the feature "by the area ratio of the integrating bypass valve" in their reasoning, which was therefore insufficient, Rule 111(2) EPC. An insufficient reasoning could indeed represent a substantial procedural violation justifying the reimbursement of the appeal fee, see CLBA 2019 V.A.9.5.9.

In section 5.2 of the decision under appeal, the Opposition Division has addressed a number of clarity objections raised by the Appellant, which appear to include the above issue. Section 5.3 starts with the statement that the Opposition Division does not agree with any of these objections. In particular, the Opposition Division explains first the meaning of the term "half area" and in the following two sentences how the force balance is achieved by the area ratio. Although the term "area ratio" is not repeated, the Board is presently satisfied that these explanations represent an adequate and sufficient reasoning for the disagreement of the Opposition Division with the

corresponding clarity objection. Finally, according to established case law there is no obligation to consider each and every argument presented by the party concerned, CLBA, III.B.2.4.3 and V.B.4.3.10. In its decision the Opposition Division appears to have made a genuine attempt to address the clarity issues raised.

A procedural violation due to insufficient reasoning, which would justify reimbursement of the appeal fee, does therefore not seem to have occurred."

7.2 The Appellant did not comment on this opinion in writing or during oral proceedings. Therefore, the Board does not see a reason for deviating from it.

8. **Conclusion**

With their appeal, the Opponent successfully challenges the findings of the Opposition Division that claim 1 as upheld does not include an intermediate generalisation. The decision of the Opposition Division to maintain the patent in amended form according to the main request must therefore be set aside.

The subject-matter of claim 1 according to auxiliary request 1 also extends beyond the content of the application as filed for similar reasons, Article 123(2) EPC, and claim 1 of auxiliary request 2 does not meet the requirement of clarity, Article 84 EPC. Given that the remaining auxiliary requests 3 to 5 are not admitted for violating the principle of *reformatio in peius*, the patent must be revoked.

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