

Internal distribution code:

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

**Datasheet for the decision
of 26 June 2007**

Case Number: T 0671/04 - 3.2.04

Application Number: 94103897.8

Publication Number: 0623741

IPC: F02C 7/275

Language of the proceedings: EN

Title of invention:

Gas turbine starter assist torque control system

Patentee:

AlliedSignal Inc.

Opponent:

John Grahame Marshall

Headword:

-

Relevant legal provisions:

EPC Art. 100(c)

Keyword:

"Amendments - added subject-matter (main request) (no)"

Decisions cited:

-

Catchword:

-



Case Number: T 0671/04 - 3.2.04

D E C I S I O N
of the Technical Board of Appeal 3.2.04
of 26 June 2007

Appellant: AlliedSignal Inc.
(Patent Proprietor) 101 Columbia Road
P.O. Box 2245
Morristown
New Jersey 07962-2245 (US)

Representative: TBK-Patent
Bavariaring 4-6
D-80336 München (DE)

Respondent: John Grahame Marshall
(Opponent) SEARJEANTS
25 The Crescent, King St
Leicester LE1 6RX (GB)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 25 March 2004
revoking European patent No. 0623741 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: M. Ceyte
Members: A. de Vries
H. Preglau

Summary of Facts and Submissions

I. On 24 May 2004 the Appellant (Proprietor) lodged an appeal against the Opposition Division's decision of 25 March 2004 to revoke the patent as granted and paid the prescribed appeal fee. The grounds of appeal were filed on 21 July 2004.

Opposition was filed against the patent as a whole and based on Article 100(c) EPC as the subject-matter of the granted patent extended beyond the content of the application as filed.

The Opposition Division held that the grounds mentioned in Article 100(c) EPC prejudiced the maintenance of the patent.

II. The Appellant (Proprietor) requested, as a main request, that the decision under appeal be set aside and the patent be maintained unamended. Alternatively, he requested maintenance of the patent in amended form by amendment of claims 1 and 4 in accordance with a first auxiliary request filed with the grounds of appeal, a second auxiliary request filed with letter of 9 June 2005, or second or third auxiliary requests as filed with the grounds and renumbered as third and fourth auxiliary requests respectively.

The Respondent (Opponent) requested that the appeal be dismissed.

Both parties requested as an auxiliary request oral proceedings

III. Oral proceedings before the Board were held on 26 June 2007.

IV. The wording of the independent claims of the main request is as follows:

1. " A method of accelerating a gas turbine engine (10) by means of a starter motor along a predetermined schedule, which is a schedule of acceleration rate versus engine speed, stored in function generator (68), wherein a starter/generator (17) is employed as said starter motor;

engine speed is sensed and a first signal indicative of said engines actual acceleration is sent to an electronic control unit (50) programmed with said predetermined schedule; and

a second signal indicative of the predetermined acceleration for said engine as stored in function generator (68) is produced and said first and second signals are combined to form an error signal;

said electronic control unit (50) controls acceleration of said engine by continuously adjusting the torque output of said starter/generator (17) to the engine in response to said error signal, so that the starter/generator delivers only the torque necessary to keep the engine accelerating along said schedule, said schedule including

(a) a first phase prior to ignition of said engine, in which said starter/generator provides power to said engine so as to accelerate said engine;

(b) a second phase subsequent to said first phase, in which said starter/generator halts the acceleration of

said engine and holds it at zero for a preselected period of time;

(c) igniting said engine during said second phase, and
(d) a third phase subsequent to said ignition, in which said starter/generator provides power to said engine so as to accelerate said engine at a predetermined rate slower than the acceleration of step (a)."

4." Apparatus for controlling a starter motor to accelerate a gas turbine engine (10) along a predetermined schedule, wherein said starter motor is a starter/generator (17); and in that said apparatus comprises means (52) for sensing engine speed; and means for continually adjusting the torque output of said starter/generator (17) to the engine in response to said sensed speed, so that the starter/generator delivers only the torque necessary to keep the engine accelerating along said schedule, and said schedule including

(a) a first phase prior to ignition of said engine, in which said starter/generator provides power to said engine so as to accelerate said engine;

(b) a second phase subsequent to said first phase, in which said starter/generator halts the acceleration of said engine and holds it at zero for a preselected period of time;

(c) igniting said engine during said second phase, and
(d) a third phase subsequent to said ignition, in which said starter/generator provides power to said engine so as to accelerate said engine at a predetermined rate slower than the acceleration of step (a)

and said apparatus further comprising means (64) for producing a first signal indicative of said engine's actual acceleration;

means (68) for producing a second signal indicative of a predetermined acceleration for said engine;
means (70) for combining said first and second signals to form an error signal; and
means for adjusting the torque to said engine in response to said error signal whereby said engine accelerates according to said predetermined schedule."

V. The Appellant argued as follows:

The feature of the "function generator" of granted claim 1 is based on original claims 11 to 13, as well as figure 2a read in conjunction with figure 2.

Features (a) to (d) are entirely consistent with and derivable from the graph of figure 2. This figure shows realistic target values for closed loop control of a real engine. Further support lies in a contextual reading of page 5, 2nd paragraph of the description, the graph of figure 2, and the concrete embodiment described on page 7, first complete paragraph. Finally, feature (c) as worded finds full support in page 5, lines 18 to 20.

VI. The Respondent argued as follows :

Figures 2 and 2a and the corresponding passages on page 5 and 6 constitute the sole specific disclosure of a function generator, which in both cases has at least four parameter inputs. These are essential to the solution of the original problem of cold soak mentioned on page 2, second paragraph of the description.

The claimed schedule refers to desired or target values, see e.g. page 5, lines 7 and 16, not the actual, achieved acceleration, and as such cannot take into account delays. The ramping up and down shown in the target profile of the graph in figure 2 cannot thus be explained away as due to delay but rather forms an intrinsic part of the target profile itself. Figure 2a, which must be closed loop as follows from page 6, lines 25 to 26 referring to an error signal, also does not take into account delays. This figure, which shows a schedule with the claimed features but in a different context has been deleted and cannot provide a basis for the claims in their amended, granted form.

The claimed schedule is moreover inconsistent with the torque graphs of Figure 3. These show increasing torque and acceleration in the post ignition phase, as well as ignition prior to the dwell point where acceleration is zero. In this respect step (c) is unsupported by the original disclosure, which, see page 5, lines 18 to 20, or page 7 ,lines 8 to 10, specifies only that the dwell point assures that ignition has occurred, i.e. that it should have been completed before the end of the dwell point, not that ignition should then actually take place.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.

2. *The claimed invention and its interpretation (main request)*

2.1 The invention as defined in independent claims 1 (method) and 4 (apparatus) as granted concerns the control of a starter/generator to accelerate a gas turbine engine according to a predetermined schedule of acceleration rate versus engine speed using feedback control. An error signal is developed from actual engine acceleration and the acceleration according to the schedule, and used to adjust torque output of the starter/generator. The schedule is stored in a function generator and includes three phases, a pre-ignition acceleration phase (a), followed by a phase (b) in which acceleration is halted and the engine is ignited (c), and a final phase (d) in which acceleration is resumed but at a slower rate than in phase (a). Steps (b) and (c) in particular assure that ignition occurs by maintaining the engine at the proper speed conditions therefor.

2.2 According to the wording of the claims in step (d) the engine is accelerated "at a predetermined rate slower than *the* acceleration in step (a)" (italics added by the Board). Step (a) however does not specify a particular rate of acceleration. Nevertheless, the Board reads the reference to "*the* acceleration in step (a)" in the wording of step (d) as implying a predetermined rate of acceleration in step (a).

3. *Allowability of the amendments (main request)*

3.1 The Board identifies originally filed claim 13, dependent on claims 11 and 10, as the main basis for

granted claims 1 and 4. Though original claim 13 is directed to a system (apparatus), its purely functional terms allow it to serve as a basis for granted claims 1 and 4 to a method respectively an apparatus, each defined in equally functional terms. Claim 13 includes the main features of control by feedback of the starter/generator on the basis of an error signal developed from actual acceleration and a value according to a predetermined schedule of acceleration as a function of engine speed (first three features of claim 13), and, in response to the error signal, adjusting the torque applied by the starter/generator so as to accelerate the engine along a predetermined schedule (final feature of claim 13).

3.2 Original claim 13 does not explicitly mention the feature of granted claims 1 and 4 of **a schedule stored in a function generator**. However, the Board finds this feature to be implicit in claim 13. In the Board's understanding, and contrary to the Respondent's assertion, the term "function generator" has no specific meaning, either of its own or in the context of the whole disclosure, other than denoting a functionality of e.g. a processor or computer that outputs a signal corresponding to the value of a specified function for a given input value or values of its independent variable input or inputs. It may thus be identified as the "means for establishing a predetermined acceleration schedule as a function of speed" of original claim 13, which means must also necessarily store the function or schedule in some form.

3.2.1 The above finding is entirely in keeping with the function generator of the figure 2 embodiment described

on page 5, lines 1-13 of the original description. Box 68 designating the function generator shows inputs T_{OIL} , P_2 and T_2 (described as oil temperature in sump, inlet pressure and temperature respectively) as well as speed N_s (from electronic conditioner 62). However, the graph contained in box 68 clearly shows what the skilled person reads as the main dependency of the control function of acceleration on speed; in this reading inputs T_{OIL} , P_2 and T_2 (which represent external parameters that are relatively invariant during the short start-up time) play a subsidiary role. This is underscored by the fact that the schedule is defined as a function of speed in original claim 11, while inlet conditions and oil temperature feature as further parameters only in original claim 12 appendant to claim 11.

- 3.2.2 The Board also sees no inconsistency with regard to the problems mentioned in the description and features essential to their solution. Firstly, such an argument bears upon clarity, rather than upon a ground of opposition under Article 100 EPC. Moreover, the problems originally addressed in the application are much broader than that of cold soak identified by the Respondent, cf. page 2, lines 13 to 15 and the following two paragraphs. The original solution resided in the general idea of automatic control based on sensed speed rather than any particular schedule, let alone a schedule stored in a plural input function generator. Similarly, such further inputs are immaterial to the central idea of the granted patent of assuring ignition through the use of a dwell point in the control schedule.

3.3 Original claim 13 did not specify any of **steps (a) to (d)** of the predetermined schedule. The Board finds the basis for these features in the following parts of the originally filed application when read contextually and considered in conjunction with each other:

the graphs of figures 2 and 2a;
description page 5, lines 15 to 27;
description page 6, lines 18 to 28; and
description page 7, lines 3 to 15.

3.3.1 The Board notes that, though figure 2a and the corresponding parts of the description were deleted in the pre-grant procedure, they nevertheless remain an integral part of the content as originally filed as referred to in Article 123(2) EPC. The present situation is thus distinct from that of post grant reinstatement of matter deleted before grant, where the issue falls under paragraph 3 of Article 123 EPC, or that of the reinstatement of matter which has been expressly abandoned, such reinstatement being barred in both cases. In this case material no longer appearing in the granted patent is not being reinstated, but is rather relied upon as basis in the original disclosure for pre-grant amendments. Thus, features, which have been disclosed in the application as filed but which have been deleted before grant are within the "content of the application as filed" for the purpose of Article 123(2) EPC.

3.3.2 The graphs of figures 2 and 2a, neither of which includes specific values, are clearly highly schematic in nature and allow only the most general qualitative information to be derived therefrom. While figure 2 depicts acceleration rate ("ACCEL. RATE") against speed

(N_s), figure 2a shows speed against time. Nevertheless, the two may be compared and are seen to share certain salient features. In particular, both show three distinct phases, in particular a first constant acceleration phase, followed by a second phase with constant speed/zero acceleration and a final phase in which acceleration is resumed but at a rate slower than in the first phase. These phases correspond to steps (a), (b) and (d).

- 3.3.3 Lines 15 to 27 of page 5, deal with the central feature in the schedule of figure 2 of a "dwell point", identified as a "pause in the acceleration" intended to "assur[e] that ignition *is occurring*" (italics added by the Board). Lines 18 to 22 add that acceleration is resumed after receipt of "an EGT signal indicating ignition *has occurred*" or, alternatively, after elapse of a certain amount of time. The latter alternative is illustrated in the specific example of page 7, where, see lines 9 to 10, a 5 second pause "assures that ignition *has occurred*". Finally, page 7, line 22, in a paragraph comparing DC starter performance, indicates that such a starter "cannot be halted to ... wait for the igniter to fire". From a contextual reading of these passages the skilled person unambiguously infers that ignition is entirely contained within the "dwell point" which thus encompasses both steps (b) and (c) of the granted claims. A "dwell point" is also explicitly identified in the description of the figure 2a embodiment on page 6, lines 18 to 28, so that, in conclusion, both figures 2 and 2a read in conjunction with the above passages disclose steps (a) to (d) of the claimed schedule.

3.3.4 Further to figure 2, the Board views the explanation of the non-vertical flanks either side of the constant acceleration sections as well as of the finite speed range for non-zero acceleration as addressing effects of inertia and transmission in a closed loop controlled real engine as entirely reasonable. Feedback control normally considers the dynamic response of the system under control, in particular where changes between stable control states are concerned. In the Board's view such a dynamic response may, for example, be in evidence in the torque characteristic of figure 3. This latter figure, the Board however notes, is intended to illustrate the effects of the claimed invention, in the form of generalized characteristics, which do not represent precise empirical observations. The Board is thus wary of drawing other than the most general conclusions from this figure, much less that it appears contradictory to or inconsistent with the claimed schedule.

3.4 In conclusion the Board finds that claims 1 and 4 as granted have a clear basis in the original application documents. The patent as granted is therefore not prejudiced by the ground mentioned under Article 100(c) EPC. In consequence consideration of the auxiliary requests (first to fourth) is superfluous.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is maintained unamended.

The Registrar

The Chairman

G. Magouliotis

M. Ceyte