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Datasheet for the decision of 11 July 2023

Case Number: T 1262/21 - 3.2.01

Application Number: 14167422.6

Publication Number: 2803519

IPC: B60K6/30, B60W10/06, B60W10/08, B60W20/00

Language of the proceedings: EN

Title of invention:
Electrical power generating engine flywheel with active torque control

Applicant:
The Boeing Company

Headword:

Relevant legal provisions:
EPC Art. 123(2), 54, 56

Keyword:
Amendments - added subject-matter (no)
Novelty - main request (yes)
Inventive step - main request (yes)

Decisions cited:

Catchword:

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Case Number: T 1262/21 - 3.2.01

D E C I S I O N
of Technical Board of Appeal 3.2.01
of 11 July 2023

Appellant: (Applicant)	The Boeing Company 929 Long Bridge Drive Arlington, VA 22202 (US)
Representative:	Howson, Richard Giles Bentham Kilburn & Strode LLP Lacon London 84 Theobalds Road London WC1X 8NL (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 23 March 2021 refusing European patent application No. 14167422.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Pricolo
Members:	A. Wagner
	S. Fernández de Córdoba

Summary of Facts and Submissions

I. The appeal was filed by the appellant (applicant) against the decision of the examining division to refuse the European patent application No. 14167422.6 pursuant to Article 97(2) EPC.

II. In the decision under appeal the examining division concluded that the subject-matter of claim 1 of the main request and of auxiliary request 1, both filed on 13 January 2021, was not novel over US 2001/0043019 A1 (D1). Auxiliary request 2, late filed after the time limit set in the summons, was not admitted into the proceedings. Furthermore the description was considered not compliant with the requirements of Article 84 EPC.

III. With the statement of the grounds of appeal the appellant requested the contested decision to be set aside and a European patent to be granted on the basis of the main request underlying the impugned decision. As an auxiliary measure, it was requested to grant a patent on the basis of one of the auxiliary requests 1 to 3 filed with the statement of grounds of appeal.

IV. After a telephone conversation with the rapporteur of the Board, the appellant filed a new main request with letter dated 14 June 2023. The previously filed main request and first to third auxiliary requests were maintained as first to fourth auxiliary requests, respectively.

V. After a further telephone conversation with the rapporteur of the Board, the appellant filed a replacement description page 2 with letter dated 5 July 2023.

VI. In the present decision reference is made to the following documents:

D1: US 2001/0043019 A1
D2: DE 93 21 005 U1
D3: DE 10 2007 050114 A1
D4: US 2011/054723

VII. The **main request** comprises two independent claims. The feature numbering is added by the Board, deletions made in claim 1 as originally filed being indicated by the Board in strikethrough and additions made underlined. **Claim 1** reads as follows:

1. An apparatus, comprising:

1.1 a flywheel generator (116) comprising:

1.1.1 a flywheel (120) attached to a crankshaft (112) of an engine (108) such that an axis of rotation of the flywheel (120) is aligned with an axis of rotation of the crankshaft (112); and

1.1.2 an electric generator including a rotor (122) attached to the flywheel (120) such that an axis of rotation of the rotor (122) is aligned with the axis of rotation of the flywheel (120); and a stator (124) positioned with respect to the rotor (122) ~~such that the rotor (122) and the stator (124) together form an electric generator 8126)~~, the electric generator (126) for generating electrical power (140) when the rotor (122) is rotated by the crankshaft (112);

1.2 the apparatus further comprising an electric power bus (150) comprising an electrical load (142), and a source (148);

1.3 an electrical power take-off (139), wherein the electric generator (126) of flywheel generator (116) is configured to provide an alternating current to the electrical power take-off (139);

1.4 a power converter (144), separate to the electric generator, connected to the electrical power bus, configured to convert electrical power (140) on the electrical power take-off (139) to electrical power that is appropriate for the electrical load (142),

1.4.1 the power converter (144) including an inverter (146) configured to convert electrical power from the source (148) to appropriate electrical power (140) for application to the electric generator to control torque applied to the crankshaft,

1.4.2 the inverter (146) further configured to provide the electrical power (140) to the electric generator (126) to start the engine (108); and

1.5 an electrical power controller (152) configured to switch the power converter (144) between providing electrical power (140) to the electrical load (142) and drawing electrical power (140) from the source (148).

Method claim 7 reads as follows:

7. A method for controlling a power system (100), comprising:

7.1 attaching a flywheel (120) to a crankshaft (112) of an engine (108) such that an axis of rotation of the flywheel (120) is aligned with an axis of rotation of the crankshaft (112);

7.2 attaching a rotor (122) ~~to a crankshaft (112) of an engine (108)~~ to the flywheel (120) such that an axis of rotation of the rotor (122) is aligned with the axis of rotation of the flywheel (120);

7.3 positioning a stator (124) with respect to the rotor (122) such that the rotor (122) and the stator (124) together form an electric generator (126) for generating electrical power (140) when the rotor (122) is rotated by the crankshaft (112);

7.4 controlling an electrical current (128) in the electric generator (126) to control mechanical power (136) provided by the crankshaft (112) when the engine (108) is running;

7.5 the electric generator (126) providing an alternating current from the electric generator (126) to an electrical power take-off (139);

7.6 a power converter (144), separate to the electric generator, and connected to an electric power bus (150),
7.6.1 the electric power bus comprising an electrical load (142) and a source (148),
7.6.2 the power converter converting electrical power (140) on the electrical power take-off (139) to electrical power that is appropriate for the electrical load (142),
7.6.3 the power converter (144) including an inverter (146) converting electrical power from the source (148) to appropriate electrical power (140) for application to the electric generator to control torque applied to the crankshaft,
7.6.4 the inverter (146) configured to provide the

electrical power (140) to the electric generator (126) to start the engine (108); and

7.7 an electrical power controller (152) switching the power converter (144) between providing electrical power (140) to the electrical load (142) and drawing electrical power (140) from the source (148).

Reasons for the Decision

1. Article 123(2) EPC

1.1 The Board is satisfied that the amendments made do not introduce added subject-matter.

1.2 Claim 1 of the main request is based on original claim 1, figure 1 and the following paragraphs of the A1-publication EP 2 803 519 A1 of the application in suit:

- paragraph [0023] for feature 1.1;
- paragraphs [0033] and [0036] for features 1.2 and 1.4;
- paragraph [0032] for feature 1.3
- paragraph [0034] for features 1.4.1 and 1.4.2
- paragraph [0037] for feature 1.5.

The amendments made in feature 1.1.2 are a redraft of the original wording without any additional technical information.

1.3 Method claim 7 of the main request combines the features of originally filed claims 7, 8 and 9 supplemented by features from paragraphs [0032] to [0034], [0036] and [0037] of the A1-publication of the application in suit - in accordance to the amendments made in claim 1:

- claims 8 and 9 for features 7.1, 7.2;
- paragraph [0032] for feature 7.5;
- paragraphs [0033] and [0036] for features 7.6, 7.6.1 and 7.6.2;
- paragraph [0034] for feature 7.6.3 and 7.6.4
- paragraph [0037] for feature 7.7

1.4 Dependent claims 2 to 6 and 8 to 11 correspond to original claims 2 to 6 and 10 to 13.

1.5 Finally, the description is amended to bring it into conformity with the wording of the amended claims and to acknowledge the relevant prior art.

2. Article 54 EPC

2.1 The amendments made to claim 1 of the main request in appeal proceedings overcome the novelty objection raised in the impugned decision.

2.2 Compared to the main request in examination proceedings, claim 1 on file now specifies
- that the apparatus has an electric power bus 150 comprising an electrical load 142 and a source 148 (feature 1.2),
- that a power converter is connected to the electrical power bus and is configured to convert electrical power from the electrical generator to the electrical load (feature 1.4) and
- that an inverter of the power converter is configured to convert electrical power from the source to the electrical generator to start the engine (feature 1.4.1, 1.4.2).

2.3 As argued by the appellant (applicant), the electrical load 142 and the source 148 are defined as two separate entities, both connected to the power converter 144 by electrical power bus 150. To switch between the two different modes of operation as well as between the source and the electrical load, an electrical power controller as defined in feature 1.5 is provided.
The amendments clarify that the apparatus uses the same converter for drawing electrical power from a source (e.g. a battery) and for providing electrical power to an electrical load (other than the source).

2.4 D1 discloses an apparatus ("electric machine 48") comprising "*a starter/generator machine. This type of device is used both to start an internal combustion engine and to obtain electric energy and, if appropriate, feed the electric energy obtained into a vehicle electrical network whenever the internal combustion engine is running*" (paragraph [0019]).

2.5 Further on, in paragraph [0045], D1 discloses that "*the electric machine 48 of FIG. 1 may, for example, comprise a starter/generator arrangement used for supplying current to produce rotational energy for starting an internal combustion engine. When the internal combustion engine has been started and is itself producing rotational energy, the electric machine 48 may then operate as a generator which feeds electric energy into a motor vehicle battery.*".

2.6 It is noted that a generator as disclosed in D1 normally produces alternate current (AC) and that a battery usually stores or delivers direct current (DC) - as found by the examining division (impugned decision, point 13). In order to feed energy to the battery (acting as an electrical load), D1 implicitly discloses at least a converter that converts AC to DC as required by feature 1.4.

2.7 However, D1 does not disclose how the starter/generator arrangement supplies current to start the internal combustion engine. No details are mentioned regarding the components of such an arrangement. Thus it remains open if the starter/generator arrangement draws energy from the same battery (acting as a source) to which energy is delivered when the arrangement operates as a generator, or if an additional starter component is provided.

2.8 Consequently, D1 does not directly and unambiguously disclose

- an electrical power bus according to feature 1.2 comprising a source (e.g. a battery, see paragraph [0035] of the application in suit) and additionally an electrical load;
- a converter connected to the power bus, the converter being able to convert electrical power from the source to the electric generator and from the electric generator to the electrical load,
- an electrical power controller that switches the converter between the two entities.

2.9 Even if it was assumed that the battery mentioned in D1, paragraph [0045], served as a source and as electrical load, and as a consequence a converter for converting DC to AC to start the engine and a converter for converting AC to DC to feed the battery was implicitly disclosed, claim 1 still differs from D1 in that just one converter connected to an electrical power bus is used, that the source and the electrical load are separate entities and that an electrical power controller according to feature 1.5 is provided.

2.10 Claim 1 is thus new over D1. The same applies mutatis mutandis to method claim 7.

3. **Article 56 EPC**

3.1 D1 is considered the closest prior art. The distinguishing features as mentioned under point 2.8 above, point 2.9 respectively, solve the problem of an increased operability. By providing the ability to switch between drawing electric power from the source and directing power to a separate electric load, a less complex, lighter and thus more efficient apparatus is provided.

3.2 None of the documents cited in the European search report renders the claimed subject-matter obvious. D1 is silent about any technical solution for providing the functions as described in paragraphs [0019] or [0045]. When confronted with the problem of how to connect an apparatus according to D1 with a source to start the engine and with the vehicle network to increase operability, no hint to the specific solution as claimed in the application is derivable from any of the documents D1 to D4. D2 is directed to the cooling of a generator, D3 and D4 concern engine control.

3.3 Therefore, the subject matter of claims 1 and 7 is not rendered obvious by the available prior art. The requirements of Article 56 EPC are thus met.

Order

For these reasons it is decided that:

1. The decision is set aside.

2. The case is remitted to the department of first instance with the order to grant a European patent on the basis of the following documents:

- Claims 1-11 (main request) filed 14 June 2023
- Description pages 1, 3-25 filed 14 June 2023
- Description page 2 filed 5 July 2023
- figures as originally filed

The Registrar: The Chairman:

A. Voyé G. Pricolo

Decision electronically authenticated