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Case Number: T 1645/18 - 3.2.01

Application Number: 13725227.6

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Language of the proceedings: EN

Title of invention:
DUAL FUNCTION SOLID STATE CONVERTER

Applicant:
Illinois Tool Works Inc.

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 1645/18 - 3.2.01

D E C I S I O N
of Technical Board of Appeal 3.2.01
of 24 June 2019

Appellant: (Applicant)	Illinois Tool Works Inc. 155 Harlem Avenue Glenview, IL 60025 (US)
Representative:	Trinks, Ole Meissner Bolte Patentanwälte Rechtsanwälte Partnerschaft mbB Postfach 10 26 05 86016 Augsburg (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 1 February 2018 refusing European patent application No. 13725227.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Pricolo
Members:	J. J. de Acha González
	S. Fernández de Córdoba

Summary of Facts and Submissions

I. The appeal of the applicant stems from the decision of the Examining Division to refuse the European patent application No. 13 725 227.6 on the grounds that the subject-matter of claims 1 and 8 of all requests (main request and auxiliary requests I to V) lacked an inventive step (Article 56 EPC).

II. Claim 1 of the main request underlying the decision under appeal reads as follows:

"1. A dual purpose power converter (18), operable from an applied alternating current supply within an airport environment and providing a primary AC output current to a parked aircraft (12) and a secondary DC output current to one or more electrically powered ground service vehicles (22), comprising:

- a rectifier circuit (100) for converting the applied alternating current to a direct current for simultaneous use by a parked aircraft (12) and associated ground service vehicles (22);
- an inverter circuit (106) for converting said direct current to the primary AC output current for use by said parked aircraft (12) or a DC-DC converter (142) for converting said direct current to DC output current for use by said parked aircraft (12);
- a direct current conversion circuit (114) for converting said direct current to the secondary DC output current for use by said service vehicles (22); and
- a control circuit (122) for controlling operation of said rectifier circuit (100), said inverter circuit (106) and said conversion circuit (114) in

response to control signals."

Claim 8 of the main request is directed to a method of using the dual purpose power converter of one of the preceding claims.

III. The Examining Division argued that the subject-matter of claim 1 was obvious in view of document

D7: JP H3 5298 A.

The Examining Division considered that the subject-matter of claim 1 differed from the known system in that:

i) rather than a dual purpose power converter system as in D7, wherein a rectifier in a central location supplied rectified AC power to a plurality of inverter circuits and direct current conversion circuits at the end of each passenger bridge, claim 1 defined a dual purpose power converter, which normally meant that the different components formed a single apparatus;

ii) the control circuit according to claim 1 not only controlled the inverter circuit, but also the rectifier circuit, which meant that the rectifier circuit comprises active switches.

According to the Examining Division, it would be an obvious measure to replace the common central rectifier 3 of the power converter arrangement of figure 4 of D7 by separate rectifiers, such that a separate rectifier was provided for each inverter circuit 7 and direct current conversion circuit 11 at the end of each passenger bridge. The choice for separate rectifiers might depend on economic considerations, based on the

price of the large capacity rectifier circuit vs. the price of plural smaller capacity rectifier circuits, the number of passenger bridges, the distances between the passenger bridges, and the distances between the ends of the passenger bridges at the airport. Regarding the second distinguishing feature, it was common technical knowledge that a rectifier circuit might comprise active switches, such as MOSFETs or IGBTs, and that a control circuit which generated the drive signals for the switches of an active rectifier circuit was provided. With the active rectifier circuit, the inverter circuit and the direct current conversion circuit placed together near the end of a passenger bridge, it would be obvious to provide a combined controller for these three power converting circuits.

IV. With the statement of grounds of appeal the appellant requested to set aside the decision of the Examining Division and to grant a patent on the basis of the main request or one of auxiliary requests I to V underlying the decision under appeal. Oral proceedings were requested as an auxiliary measure.

V. As regards the main request, the appellant submitted that in addition to the above-mentioned distinguishing features i) and ii), the subject-matter of claim 1 was further distinguished from the system of D7 in that

iii) the rectifier circuit converted the applied alternating current to a direct current for simultaneous use by a parked aircraft and associated ground surface vehicles.

In fact, the output DC power of a specific spot in D7 was used to charge the battery unit of a service

vehicle when the airplane was not parked at the specific spot. Accordingly, the system of document D7 was not suitable for simultaneously providing power to a parked aircraft and an associated ground service vehicle.

Moreover, the "main idea" of document D7 was to establish a decentralized power supply system for airplanes. In this regard, it was an essential aspect according to the system of document D7 that the rectifier circuit was provided as a large capacity rectifier circuit and was not in the vicinity of the respective inverter circuits. Arranging multiple rectifiers near the inverters would be against the teaching of document D7, because the whole point of document D7 was to avoid a rectifier for each spot (passenger bridge). Hence, document D7 taught away from the dual purpose power converter according to the present application.

Regarding distinguishing feature ii), based on the system of document D7, it would not make any sense to control both the inverter circuit and the rectifier circuit with one single control circuit.

VI. With communication dated 6 September 2018, the appellant was informed that the Board intended to set aside the decision under appeal and remit the case to the department of first instance for further prosecution. With letter dated 8 November 2018 the appellant stated its agreement.

Reasons for the Decision

1. Main request - inventive step

1.1 The subject-matter of claim 1 involves an inventive step in view of the prior art available (Article 56 EPC).

1.2 Claim 1 is directed to a dual purpose power converter suitable for use within an airport environment, that is supplied with alternating current and which can supply either an AC output current (this corresponds to the embodiment of Fig. 12) or a DC output current (this corresponds to the embodiment of Fig. 15) to a parked aircraft, and, in addition, a DC output current to one or more electrically powered ground service vehicles.

The Board agrees with the Examining Division that the claim must indeed be construed as defining a power converter as a single apparatus.

1.3 Document D7, which is considered to represent the closest prior art, discloses a system comprising the following features (using the terms of claim 1):

A dual purpose power converter, operable from an applied alternating current supply within an airport environment (see the abstract and Figs. 1 to 3) and providing a primary AC output current to a parked aircraft (at spot 6) and a secondary DC output current to one or more electrically powered ground service vehicles (at spot 6), comprising: an inverter circuit (7) for converting said direct current to the primary AC output current for use by said parked aircraft; and a direct current conversion circuit (11) for converting

said direct current to the secondary DC output current for use by said service vehicles (see top portion of Fig. 1, showing the inverters 7 adjacent to the converters 11).

Document D7 does not discloses a dual purpose power converter which also comprises a rectifier circuit. According to the teaching of D7, a common large rectifier 3 is provided in a terminal building. The DC power supplied by said rectifier is distributed (see Figs. 1 and 2) to inverters 7 positioned in the vicinity of each of plural spots 6 via power cables 5 along a plurality of bridges 4, and to converters 11 arranged in the vicinity of each of plural spots 6 (with the inverters 7, see Figs. 1) or at the terminal building 1 side (see machine translation, "Example" and Fig. 1). Since the dual purpose power converter of D7 does not have a rectifier, the feature of claim 1 "a rectifier circuit (100) for converting the applied alternating current to a direct current for simultaneous use by a parked aircraft (12) and associated ground service vehicles" must be regarded as a distinguishing feature. In this respect it is noted that the Examining Division took the view (see point 14.7 of the decision) that the electrical system of D7 as such is suitable for simultaneously providing power to a parked aircraft and to an associated ground service vehicle, and that anyway this would only require using the normal skills and knowledge of the skilled person. However, it cannot be inferred from D7 whether the dual purpose power converter as such is suitable for simultaneously providing power to a parked aircraft and to an associated ground service vehicle. In fact, the system of D7 could be designed such that either DC current is supplied by converter 11 or AC current is supplied by inverter 7 but never both

simultaneously, as D7 clearly discloses that a service vehicle is supplied with current when no airplane is parked at spot 6 (see machine translation, section "Example").

Furthermore, there is no disclosure in D7 of a control circuit for controlling operation of said rectifier circuit, said inverter circuit and said conversion circuit in response to control signals.

Finally, there is no disclosure in D7 of the alternative of claim 1 concerning a DC-DC converter for converting said direct current to DC output current for use by said parked aircraft.

1.4 The technical effect of the distinguishing features is to provide a single apparatus capable of supplying an aircraft either with AC (first alternative of claim 1) or DC (second alternative of claim 1) current and simultaneously supplying service vehicles with DC current (see also par. [002] of the application).

Accordingly, the objective technical problem can be regarded as providing a power converter for improving electrical power distribution in an airport.

1.5 Document D7 starts from a prior art in which a power converter is provided at each spot close to an airplane for supplying AC current to an aircraft. The power converter includes a rectifier supplied with commercial AC current and converting it to DC current, and an inverter converting the DC current to AC current for use by the parked aircraft. Furthermore, power substations for charging the batteries of service vehicles are provided at separate locations, namely at the terminal building side (see machine translation,

sections "prior art" and "object of the invention").

According to the disclosure of D7, this prior art has many disadvantages, in particular each power converter and each power substation needs its own rectifier, increasing costs and space requirements.

In order to overcome these disadvantages, D7 proposes to provide a common large rectifier 3 in a terminal building that distributes direct current to the various power converters constituted by a DC-AC inverter 7 and a DC-DC converter 11.

There is no indication in D7 that would suggest to the skilled person to depart from the specific teaching of D7 of providing a common large rectifier and instead provide each power converter constituted by a DC-AC inverter 7 and a DC-DC converter 11 with a rectifier. Nor is there any indication in D7 suggesting that the provision of a rectifier in each power converter with a suitable control circuit would allow simultaneous use of current by a parked aircraft and associated ground service vehicle.

Accordingly, there is no indication in D7 that would suggest the claimed solution to the above-mentioned problem.

1.6 The decision under appeal further refers to document D3. This document however relates to a power converter for providing only an alternating output voltage to an aircraft (see paragraphs [0001] to [0003]) and thus would also not suggest the claimed solution.

1.7 The Examining Division did not refer to other documents as regards inventive step of claim 1 of the main

request. The Board considers that the other prior art documents cited in the examination proceedings are also not prejudicial to the inventiveness of the claimed subject-matter.

Accordingly, the subject-matter of claim is not rendered obvious by the prior art (Article 56 EPC).

1.8 Claim 8 relates to a method using a converter having all the features of claim 1 and likewise its subject-matter is not obvious.

2. In view of the above, the decision under appeal is to be set aside since the sole ground for the refusal of the main request does not apply.

The Board considers appropriate to remit the present case to the Examining Division for further prosecution (Article 111(2) EPC). The appellant expressed its agreement in writing.

3. It is further noted in regard to other requirements of the EPC that, as pointed out by the appellant itself, the description has to be adapted. Further, concerning the requirements of Article 84 EPC and as already mentioned by the Board in its communication, claim 1 needs to be amended to remove the inconsistency caused by reciting first that the converter provides a primary AC output current to a parked aircraft and a secondary DC output current to one or more electrically powered ground service vehicles, and then defining that as an alternative to the primary AC output current a DC output current can be supplied to a parked aircraft. Accordingly, the characterising part should also be amended to specify that the control circuit also

controls the DC-DC converter in the DC output current alternative.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division for further prosecution.

The Registrar: The Chairman:

A. Pinna G. Pricolo

Decision electronically authenticated