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**D E C I S I O N**  
**of 22 February 2005**

**Case Number:** T 0735/01 - 3.5.3

**Application Number:** 96900128.8

**Publication Number:** 0803085

**IPC:** G05F 1/56

**Language of the proceedings:** EN

**Title of invention:**  
Electrical apparatus

**Applicant:**  
Autotronics Engineering International Limited, et al

**Opponent:**  
-

**Headword:**  
DC power converter/AUTOTRONICS

**Relevant legal provisions:**  
EPC Art. 54, 56, 123

**Keyword:**  
"Novelty - yes (after amendment)"  
"Inventive step - yes (after amendment)"  
"Amendments - added subject-matter (no)"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 0735/01 - 3.5.3

**D E C I S I O N**  
**of the Technical Board of Appeal 3.5.3**  
**of 22 February 2005**

**Appellant:** AUTOTRONICS ENGINEERING INTERNATIONAL LIMITED  
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**Decision under appeal:** Decision of the examining division of the  
European Patent Office posted 15 January 2001  
refusing European application No. 96900128.8  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** A. S. Clelland  
**Members:** F. van der Voort  
M.-B. Tardo-Dino

## Summary of Facts and Submissions

- I. This appeal is against the decision of the examining division to refuse European patent application 96 900 128.8, which was published as international application WO 96/21892 A pursuant to Article 158(1) EPC.
- II. The following documents were referred to in the decision:
- D1: US 4 827 205 A;
- D2: "Spannungsregler im Automobil", Elektronik, vol. 32, no. 2, 28.1.1983, pages 82 to 84; and
- D3: J. Wong, "Spannungsregler mit minimaler Verlustleistung", Elektronik, vol. 40, no. 12, 1991, pages 96 and 98 to 102.
- III. The reasons for the refusal were that the subject-matter of claim 1 of a main request was not new having regard to the disclosure of D1 or D2 (Article 54 EPC), whereas the subject-matter of claim 1 of each of four auxiliary requests did not involve an inventive step having regard to either D1 or D2, or a combination of D2 and D3 (Article 56 EPC).
- IV. With the statement of grounds of appeal the appellant filed new main and first auxiliary requests and submitted arguments in support. Oral proceedings were conditionally requested.

V. The appellant was summoned by the board to oral proceedings. In a communication accompanying the summons, the board gave a preliminary opinion and introduced, as evidence of common general knowledge, the following document known to the board and cited in accordance with Article 114(1) EPC:

D4: DE 40 16 521 A.

VI. In response to the board's communication, the appellant filed a main request and four auxiliary requests, replacing all requests on file, and presented arguments in support of these requests.

VII. Oral proceedings were held on 22 February 2005 during which the appellant filed a new main request and five further auxiliary requests. Amended pages of the description were also filed. The appellant requested that the decision of the examining division be set aside and a patent granted on the basis of the main request or, failing that, on the basis of any one of the first to ninth auxiliary requests. At the end of the oral proceedings the board's decision was announced.

VIII. Claim 1 of the main request reads as follows:

"A vehicle having a DC power converter for supplying at least several watts of output power, the converter comprising:

input terminals (1, 2) having a DC input voltage supplied thereto;

a DC regulating circuit (3) electrically connected to an input resistor (R1), and to one of said input terminals (2), such that said DC regulating circuit (3)

and said input resistor are connected in series and receive said DC input voltage;

said DC regulating circuit (3) having output terminals (5, 6) which are electrically connectable to an external load, whereby said DC regulating circuit (3) can supply at least several watts of power to said external load in the form of a DC output voltage lower than said DC input voltage;

the input resistor and the DC regulating circuit being mounted in different respective locations on the vehicle;

the input resistor and the DC regulating circuit being housed in first (46) and second (14) separate heat dissipative housings, said first housing being mounted on a massive part of the vehicle to dissipate heat generated by the input resistor by conducting such heat to the massive part of the vehicle and transmitting heat generated by the input resistor to ambient air, wherein the DC regulating circuit is connected to the input resistor by a cable (9) of length at least several centimetres so that the input resistor is located distant from the DC regulating circuit."

## **Reasons for the Decision**

1. *Amendments (main request)*
  - 1.1 Claim 1 combines the subject-matter of claims 1, 2, 3, 7 and 8 as originally filed, with "resistance means" and "piece of equipment" respectively replaced by "resistor" and "massive part of the vehicle", see Figs 1, 3 and 5 and page 7, lines 11 and 16 to 19, and

page 23, lines 18 to 19 (reference being made to the application as originally filed). Further limitations are that the first and second housings are heat dissipative (cf. page 9, lines 9 to 13, and page 22, lines 14 to 17, 22 and 23) and that the DC converter is part of a vehicle (page 23, lines 3 to 7 and 18 to 20, and Fig. 11) and may supply several watts of output power (cf. page 7, lines 6 to 10). The feature that the DC regulating circuit is connected to the input resistor by a cable of length at least several centimetres finds support at page 12, lines 10 to 14. The description has been adapted to the wording of claim 1.

1.2 Claims 2, 5, 6, 7 and 8, apart from being directed to a vehicle, correspond to originally filed claims 10, 5, 6, 4 and 11, respectively. Claims 3 and 4 are both based on page 22, lines 22 to 23, Figs 7 to 10, and page 20, lines 5 to 8.

1.3 The board is therefore satisfied that the amendments according to the main request do not give rise to objections under Article 123(2) EPC. Neither do the claims in the board's view give rise to objections under Article 84 EPC.

2. *Novelty (main request)*

2.1 D1 (see the figure) discloses an on-chip voltage regulator connected in series with an off-chip resistor  $R_1$ . D1 does not disclose a voltage regulator or converter mounted on a vehicle.

- 2.2 D2 discloses a DC voltage regulator for mounting on an automobile (see the title, the abstract, page 84, last paragraph, and Figs 4 and 5). The circuit according to Fig. 4 is for converting a +12V DC input voltage to a +5V DC regulated output voltage, which is applied to an external load (CMOS circuitry), and includes a DC regulating circuit (voltage regulator LM342P5.0) which is connected in series with an input resistor R1. It is implicit that the voltage regulator is contained in a housing. D2 does not disclose constructional features of the input resistor; in particular, D2 neither discloses that the input resistor is housed in a heat dissipative housing nor that the input resistor and the voltage regulator are connected by a cable.
- 2.3 D3 discloses voltage regulating circuits for use in battery-powered devices and, in particular, for lap-top computers and portable measuring instruments (see page 96, left col., lines 1 to 4). A MOSFET (see Figs 1 and 2) acts as a controllable resistor which is part of the voltage regulating circuit. In D3 the voltage regulating circuit is not mounted on a vehicle.
- 2.4 D4 (see, in particular, col. 1, lines 6 to 16, col. 5, lines 6 to 15 and 21 to 25, and Fig. 4) discloses a mounting and cooling chassis for a high-load resistor. The chassis is suitable for accommodating commercially available ("handelsübliche") high-load resistors, in particular those in a metal housing ("Gehäusewiderstände"). The chassis may, for example, be mounted on a part of the chassis of a vehicle. D4 does not disclose any DC regulating circuit.

2.5 The subject-matter of claim 1 of the main request is therefore new over the available prior art (Article 54 EPC).

3. *Inventive step (main request)*

3.1 D2 is considered to represent the closest available prior art, since it relates to a voltage converter mounted on a vehicle.

3.2 The vehicle according to claim 1 is particularly distinguished from the disclosure of D2 (see point 2.2) in that according to claim 1:

(i) the DC power converter is for supplying at least several watts of output power;

(ii) the DC regulating circuit can supply at least several watts of power to the external load;

(iii) the input resistor is housed in a dissipative housing separate from the housing of the DC regulating circuit;

(iv) the input resistor housing is mounted on a massive part of the vehicle to dissipate heat generated by the input resistor by conducting such heat to the massive part of the vehicle and transmitting heat generated by the input resistor to ambient air;  
and

(v) the DC regulating circuit is connected to the input resistor by a cable of length at least



several centimetres so that the input resistor is located distant from the DC regulating circuit.

3.3 The above features render the converter suitable for operation at higher output power. The problem underlying the claimed subject-matter may therefore be seen in adapting the converter disclosed in D2 (see Fig. 4) such that it can output several watts of power. The formulation of this problem does not contribute to inventive step, since a tendency towards an increased use of electronics in an automobile and, consequently, an increased demand for more and stable output power already existed before the priority date (see, e.g., D2, the abstract, lines 5 to 9).

3.4 In the board's view, it is part of the ordinary skills of a person skilled in the art of power electronics to scale up an electronic circuit to increase its power-handling capability.

In the present case, an increased output power of the circuit of Fig. 4 of D2 merely requires the selection of appropriately dimensioned components (resistor, diode, voltage regulator, etc.) which support higher output currents. Hence, starting from the converter circuit of Fig. 4 of D2, the skilled person would, without the exercise of any inventive skill, arrive at a converter including a DC regulating circuit suitable for supplying at least several watts of output power.

3.5 Further, it is common general knowledge in the power electronics art to provide components with a heat sink, in particular components such as high-load resistors and semiconductors, which in use reach a high

temperature due to heat dissipation, in order to avoid damage which would otherwise be caused by an excessively high temperature.

Hence, in the present case, it would be obvious to provide the high-load resistor with a heat sink should high temperatures be encountered, e.g. at high output power. D2 points in this direction by noting that the environment of an automobile covers a wide temperature range and that semiconductor components mounted in an automobile should be provided with sufficiently large cooling surfaces (see the abstract and page 84, last paragraph). Hence, providing the input resistor R1 of the circuit disclosed in Fig. 4 of D2, when dimensioned as a high-load resistor, with a housing in the shape of a heat sink does not involve an inventive step either.

- 3.6 It is moreover common general knowledge to accommodate a circuit, such as the circuit according to Fig. 4 of D2, in a protective housing in order to protect it against a hostile environment, such as in an automobile, and to mount the housing on the automobile in view of the vehicle movements. This, however, does not imply that the protective housing should be mounted on a massive part of the automobile. Moreover, starting from the circuit according to Fig. 4 of D2, the skilled person would have no clear reason to locate the input resistor R1 away from the remaining part of the converter circuit, i.e. the DC regulating circuit, and to connect the two parts by means of a cable. In the absence of proof to the contrary, such relocation can not be held to be part of the common general knowledge of a person skilled in the art of power electronics.

- 3.7 It follows that the skilled person, starting from the teaching of D2 and applying his common general knowledge would not without the exercise of inventive skill arrive at the subject-matter according to claim 1.
- 3.8 Nor does it appear to the board that the skilled person, starting from D2 and applying his common general knowledge, would arrive at the claimed subject-matter in view of the teaching of the remaining available prior art documents D1, D3 and D4, taken alone or in combination; D1 does not provide constructional details about the input resistor  $R_1$ ; D3 discloses voltage regulating circuits without a separate input resistor connected in series therewith; and D4 does not provide details about the location of the high-load resistor relative to other components to which it is connected, except for locating two high-load resistors immediately next to each other (see D4, Figs 13 and 14).
- 3.9 The subject-matter of claim 1 therefore involves an inventive step vis-à-vis the available prior art documents (Article 56 EPC).
- 3.10 Since the subject-matter of claim 1 has been found to be new and to involve an inventive step, this also applies to claims 2 to 8, which are dependent on claim 1.
4. Since the main request is found allowable, it has not proved necessary to consider the auxiliary requests.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent on the basis of the following documents:
  - claims 1 to 8 of the main request filed during the oral proceedings;
  - amended pages 1, 3, 5, 6, 7, 10, 11, 14, 16, 22 and 23 of the description as filed during the oral proceedings, together with pages 2, 4, 8, 9, 12, 13, 15, 17 to 21 as originally filed; and
  - drawings sheets 1 to 9 as originally filed.

The Registrar:

The Chairman:

D. Magliano

A. S. Clelland