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D E C I S I O N
of 27 July 2005

Case Number: T 0293/03 - 3.5.2

Application Number: 94307919.4

Publication Number: 0650862

IPC: B60L 9/28

Language of the proceedings: EN

Title of invention:
Electric vehicle control device

Patentee:
KABUSHIKI KAISHA TOSHIBA

Opponent:
Bombardier Transportation GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Transfer of the status of opponent - accepted by EPO"
"Legitimate expectations"
"Inventive step - yes"

Decisions cited:
G 0002/04, G 0002/97, J 0027/94, T 1091/02

Catchword:
-

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Case Number: T 0293/03 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 27 July 2005

Appellant: (Opponent)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 23 December 2002 concerning maintenance of European patent No. 0650862 in amended form.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: J.-M. Cannard
C. Holtz

Summary of Facts and Submissions

I. The opponent appealed against the decision of the opposition division concerning the maintenance of European patent No. 0 650 862 in amended form in accordance with the proprietor's request filed on 21 November 2002 during oral proceedings before the opposition division.

II. The thus amended patent has four claims, all of which are independent.

Claim 1 is worded as follows:

"An electric vehicle control device comprising:

a plurality of control devices, including,

a PWM converter device (COV) for receiving a first A.C. power through a current collector (PAN) and a transformer (MT) from an A.C. overhead line and for converting said first A.C. power into a D.C. power using a PWM carrier wave,

an inverter (INV) connected to D.C. output terminals of said PWM converter device (COV) for converting said D.C. power into a second A.C. power, and

an electric motor (MM) connected to A.C. output terminals of said inverter (INV) for being driven by said second A.C. power;

wherein

the electric control device is for a first plurality of first vehicles (2, 3) and a second plurality of second vehicles (1, 4) connected in series to form a formation;

the plurality of control devices comprises a first plurality of first control devices, each being provided for one of said first plurality of said first vehicles (2, 3), respectively, and a second plurality of second control devices, each being provided for one of said second plurality of said second vehicles (1, 4), respectively;

characterised in that:

each of said second control devices further including an auxiliary power source device (APS) connected to said D.C. output terminals of said PWM converter device (COV) to receive said D.C. power for supplying power to a load (LD);

said PWM converter device (COV) in said first control device being actuated only under motoring condition or braking condition;

said PWM converter device (COV) in said second control device being constantly actuated; and

phase angles of said PWM carrier waves in said first plurality of said PWM converter devices (COV) in said first plurality of said first control devices being determined to be mutually shifted by a first predetermined angle under motoring condition or braking condition;

phase angles of said PWM carrier waves in said second plurality of said PWM converter devices (COV) in said second plurality of said second control devices being determined to be mutually shifted by a second predetermined angle constantly;

wherein in said first plurality of said first control devices, said first predetermined angle is decided to be 180°/M1, where the number of said first plurality of said first vehicles (2, 3) is M1; and

wherein in said second plurality of said second control devices, said second predetermined angle is decided to be 180°/M2, where the number of said second plurality of said second vehicles (1, 4) is M2;

thereby higher harmonics of said PWM carrier waves leaking into said A.C. overhead line being reduced."

Claim 2 is identical to claim 1 except that the last three paragraphs of claim 1 are replaced by:

"wherein each of said PWM converter devices (COV) includes PWM converters (COVA) connected in parallel with each other; and

wherein said phase angles of said PWM carrier waves in said PWM converters (COVA) in each of said PWM converter devices (COV) are determined to be mutually shifted by an angle of $180^{\circ}/N$;
wherein in said first plurality of said first control devices, aid first predetermined angle is decided to be $180^{\circ}/(N.M1)$; and

wherein in said second plurality of said second control devices, said second predetermined angle is decided to be $180^{\circ}/(N.M2)$;

where the number of said PWM converters (COVA) in each of said PWM converter devices (COV) is N, the number of said first plurality of said first vehicles (2, 3) is M1, and the number of said second plurality of said second vehicles (1, 4) is M2;

thereby higher harmonics of said PWM carrier waves leaking into said A.C. overhead line being reduced."

Claim 3 is worded as follows:

"An electric vehicle control device, comprising a plurality of control devices each including:

a PWM converter device (COV) for receiving a first A.C. power through a current collector (PAN) and a transformer (MT) from an A.C. overhead line and for converting said first A.C. power into a D.C. power using a PWM carrier wave,

an inverter (INV) connected to D.C. output terminals of said PWM converter device (COV) for converting said D.C. power into a second A.C. power, and

an electric motor (MM) connected to A.C. output terminals of said inverter (INV) for being driven by said second A.C. power;

wherein

the electric vehicle control device is for a first plurality of first vehicles (2, 3) and a second plurality of second vehicles (1, 4) connected in series to form a formation;

the plurality of control devices comprises a first plurality of first control devices, each being provided for one of said first plurality of said first vehicles (2, 3), respectively, and a second plurality of second control devices, each being provided for one of said second plurality of said second vehicles (1, 4), respectively;

characterised in that:

each of said second control devices further including an auxiliary power source device (APS) connected to said D.C. output terminals of said PWM converter device (COV) to receive said D.C. power for supplying power to a load (LD);

said PWM converter device (COV) in said first control device being actuated only under motoring condition or braking condition;

said PWM converter device (COV) in said second control device being constantly actuated;

phase angles of said PWM carrier waves in all of said PWM converter devices (COV) being determined to be mutually shifted by a first predetermined angle under motoring condition or braking condition; and

phase angles of said PWM carrier waves in said second plurality of said PWM converter devices in said second plurality of said second control devices being determined to be mutually shifted by a second predetermined angle under coasting condition;

wherein in said first plurality of said first control devices and said second plurality of said second control devices, said first predetermined angle is decided to be 180°/(M1 + M2); and

wherein in said second plurality of said second control devices, said second predetermined angle is decided to be 180°/M2;

where the number of said first plurality of said first vehicles (2, 3) is M1 and the number of said second plurality of said second vehicles (1, 4) is M2;

thereby higher harmonics of said PWM carrier waves leaking into said A.C. overhead line being reduced."

Claim 4 is identical to claim 3 except that the last four paragraphs of claim 1 are replaced by:

"wherein each of said PWM converter devices (COV) includes PWM converters (COVA, COVB) connected in parallel with each other;

wherein said phase angles of said PWM carrier waves in said PWM converters (COVA, COVB) in each of said PWM converter devices (COV) are determined to be mutually shifted by an angle of $180^{\circ}/N$;

wherein in said first plurality of said first control devices and said second plurality of said second control devices, said first predetermined angle is decided to be $180^{\circ}/(N.(N1 + M2))$;

wherein said second plurality of said second control devices, said second predetermined angle is decided to be $180^{\circ}/(N.M2)$; and

where the number of said PWM converters (COVA, COVB) in each of said PWM converter devices (COV) is N, the number of said first plurality of said first vehicles (2, 3) is M1, and the number of said second plurality of said second vehicles (1, 4) is M2;

thereby higher harmonics of said PWM carrier waves leaking into said A.C. overhead line being reduced."

III. During the appeal, the appellant referred to the documents:

D1: DE 40 37 531 A1

D3: "MACS 1500 - A modularised AC drive system for railway vehicles, supplied from high-voltage AC or DC networks", ABB Traction AB, Västerås, Sweden, 1992

D5: US-A- 4 663 702

which had been considered during the proceedings before the opposition division.

IV. Oral proceedings were held on 25 May 2005.

V. The arguments of the appellant opponent can be summarized as follows:

The electric vehicle control devices set out in claims 1 to 4 did not involve an inventive step. The features recited in the pre-characterising part of claim 1 were known from document D1, which was the closest prior art. Since it was the common practice to equip train propulsion packages with an auxiliary power source device, see document D3, it was implicit that the control devices in the locomotives of D1 had auxiliary power source devices. It was not clear from claim 1 that the first vehicles could not have auxiliary power source devices, too, because the claims did not specify any structural difference between the first control devices and the second control devices. It was known from D1 to mutually shift the PWM carrier waves of all the (N) control devices by an angle of 180°/N in order to reduce the higher harmonics leaking into the A.C. overhead line. This was also known from document D5 (claim 11 and second paragraph of the description). The first and second control devices in claim 1 merely differed from those disclosed in D1 in the calculation of the shift angles between their PWM carrier waves. In high speed trains, the PWM converters were optimized for proportional control under motoring and braking conditions, but not for providing low level energy during coasting. The problem solved by the claimed subject-matter was to reduce material costs and energy consumption. A high speed train needed a motor on every vehicle but did not need an auxiliary power source device on each vehicle. It was obvious to switch off the PWM converter devices of those vehicles which

did not have an auxiliary power source device (the first vehicles) during coasting and to calculate accordingly the phase angle between the PWM carrier waves in the second plurality of vehicles. The same considerations applied to claims 2, 3 and 4, which merely specified alternative modes for deciding the phase angles of the carrier waves. According to claim 3, all the PWM carrier waves were shifted by a first given angle during motoring and braking condition. Merely switching off half of the PWM converter devices in the formation of D1 during coasting directly resulted in a control device as recited in claim 3, when the vehicle formation comprised the same number of first and second vehicles.

VI. The arguments of the respondent proprietor can be summarized as follows:

Claims 1 to 4 as approved by the opposition division clearly specified that only the vehicles in the second plurality comprised an auxiliary power source device. Starting from the closest prior art D1, the skilled person would have to take a first step of providing different types of propulsion packages, i.e. with and without auxiliary power source devices, and a second step of allocating different phase shift angles to the carrier waves of the PWM converters in the different types of vehicles during different driving conditions before he could arrive at the invention. Neither of these steps was disclosed in the cited prior art documents and neither of them was obvious. In the prior art, e.g. D3, not all the cars in a formation had propulsion packages, but all those cars which did have propulsion packages also had auxiliary power source

devices. The opponent had not brought any new arguments during the appeal proceedings and there was no reason to set aside the decision under appeal.

VII. The appellant (opponent) requested that the decision under appeal be set aside and the European patent No. 0 650 862 be revoked.

VIII. The respondent (patentee) requested that the appeal be dismissed.

IX. While rechecking the admissibility of the appeal in the course of preparing for the oral proceedings, the Board noted that the opponent had transferred the opponent status to a former subsidiary during the first instance proceedings. After hearing the parties in the oral proceedings, the chairman closed the debate and announced that the decision of the Board was deferred until the decision in G 2/04 had been made public.

Reasons for the Decision

Admissibility of the appeal

1. Status of the opponent

1.1 In the decision of the Enlarged Board of Appeal in the case G 2/04, the answers given under point I of the order are:

(a) The status as an opponent cannot be freely transferred.

(b) A legal person who was a subsidiary of the opponent when the opposition was filed and who carries on the business to which the opposed patent relates cannot acquire the status as opponent if all its shares are assigned to another company.

1.2 Thus, in view of that decision of the Enlarged Board of Appeal and the situation outlined briefly in paragraph IX above, it has become necessary for the present Board to consider the question of the status of the opponent.

1.3 In the present case, the European Patent Office informed the parties in its communication dated 8 March 2002 that the name of the opponent O1, DaimlerChrysler AG, as from 21 January 2002, had been amended to Bombardier Transportation GmbH. Ever since then, the professional representative for Bombardier Transportation GmbH has been acting in the belief that he was acting for the correct opponent. This situation lasted, unquestioned, for more than three years, during which time the opposition division held oral proceedings and issued the decision under appeal. In that decision, the transfer of opponent status to Bombardier Transportation GmbH was acknowledged by the opposition division. In view of this, when the professional representative for Bombardier Transportation GmbH filed and pursued the present appeal, he did so in the legitimate expectation that everything he had done had been done in the name of the correct opponent. Relevant case law concerning the protection of legitimate expectations is: G 2/97 (OJ 1999, 123), paragraph 4.1 of the reasons; J 27/94 (OJ 1995, 831), paragraph 9 of the reasons; T 161/96 (OJ

1999, 331), paragraph 4 of the reasons concerning the application of the principle of good faith to all parties, including opponents.

1.4 When the present Board made its initial review of the admissibility of the appeal, it did not at that time question the right of Bombardier Transportation GmbH to file the present appeal. There was no reason to do so then, given that it had already been accepted by the first instance and that this had not been contested by the patent proprietor. Furthermore, Technical Board of Appeal 3.3.4 had not yet issued its decision T 1091/02 of 23 July 2004 in which it referred the questions concerning the transfer of opponent status to the Enlarged Board of Appeal. The questions were published in the official journal of the European Patent Office in November 2004 (OJ 2004, 542).

1.5 The Board accepts that in the present case the opponent is entitled to rely on the legitimate expectation which accrued over a period of more than three years before the decision in case G 2/04 was made public, and therefore has decided not to challenge, retrospectively, the status of the opponent in the present proceedings.

1.6 Since the requirements of Articles 106 to 108 and Rule 64 EPC have been met, the appeal is admissible.

2. The novelty of the subject-matter of claims 1 to 4 has not been disputed by the appellant.

Inventive step

3. It is common ground that document D1 represents the closest prior art. D1 (figure 1; page 2, line 52 to page 3, line 2) discloses an electric vehicle control device for a formation comprising first and second locomotives (L1, L2) connected in series.

3.1 More specifically, the vehicle control device known from D1 comprises the following features in common with the electric vehicle control devices according to claims 1 to 4:

- a plurality of four control devices (4) (i.e. two for each of the first and second locomotives),

- each control device comprises a PWM converter device (GR1, GR2) for receiving a first A.C. power through a current collector (2) and a transformer (3) from an A.C. overhead line and for converting said first A.C. power into a D.C. power using a PWM carrier wave (shown in figure 3 of D1), an inverter (WR) connected to D.C. output terminals of the PWM converter for converting the D.C. power into a second A.C. power, and an electric motor (5, 6) connected to the inverter outputs for being driven by said second A.C. power.

3.2 D1 does not explicitly disclose control devices which are equipped with an auxiliary power source device (APS) connected to D.C. output terminals of the PMW converter devices to receive the D.C. power for supplying power to a load. But it is the conventional practice for an electric locomotive to have such an auxiliary power source device for supplying the necessary power to

auxiliary electrical equipment. Each locomotive of D1 has to be understood as comprising an auxiliary power source device, although it cannot be assumed that it would be connected to the D.C. output terminals of one of the PWM converter devices.

3.3 Figure 3 of document D1 shows the four PWM carrier waves (D1, D1', D2, D2') for the two PWM converter devices of the first locomotive and a PWM carrier wave (D3) for the first PWM converter device of the second locomotive. As may be seen from figure 3 and the description at page 2, lines 31 to 40 and page 3, lines 51 to 58, all the carrier waves of the PWM devices of both locomotives are mutually shifted by a first predetermined angle of 45°, thereby reducing higher harmonics of said PWM carrier waves leaking into the A.C. overhead line.

4. As noted above in paragraph 3.2, D1 does not mention an auxiliary power source device and *a fortiori* whether or not is connected to the D.C. output terminals of one of the PWM converter devices. If such a connection is assumed for the sake of argument, such that the D1 locomotives would exhibit a plurality of "second control devices" in the meaning of the claims, there would be nothing corresponding to the "first vehicles" or to the "first control devices" whose PWM converter devices are actuated only under motoring or braking conditions. On the other hand, if it is assumed that the auxiliary power source device is not connected to the D.C. output terminals of one of the PWM converter devices, the D1 locomotives would not exhibit the "second control devices" in the meaning of the claims.

5. Although the embodiment described in detail in D1 is for locomotives, the more general word "Triebfahrzeug" - motorised vehicle - is used on page 4 in lines 6, 7 and 9 concerning the advantages of the control method according to D1. Furthermore, the claims of D1 are not limited to locomotives. Thus it may be considered that the control device of D1 is applicable to a formation comprising four motorised railway vehicles, the four control devices described in D1 being disposed one each in four respective vehicles. However, it cannot be derived from D1, nor is it suggested there that only two of the four vehicles would have a propulsion package with an auxiliary power source device.

6. There is a brief mention at line 6 on page 4 of D1 that different types of motorised vehicles may be used, but no details at all are given as to in what respect the different types of motorised vehicles may differ. There is no disclosure in any of the prior art documents D1, D3 and D5 of differently equipped motorised vehicles corresponding to the first and second vehicles as specified in the present claims being controlled by one overall control system. It is true that in document D3, there are two different types of vehicles mentioned, i.e. with or without propulsion packages, but it is clear from page 6 of D3 (which was specifically referred to by the appellant) that all the propulsion packages are equipped with auxiliary converter modules supplying electrical equipment such as fans, lighting and power outlets. It is therefore clear that all the PWM converter devices must be constantly actuated and none of them can be switched off under coasting condition. In other words, D3 does not disclose or remotely suggest the "first plurality of vehicles" or

the "first control devices" as meant in the present set of claims 1 to 4.

7. Since there is no hint in the cited prior art of a train formation in which some of those vehicles which are provided with propulsion packages are not provided with auxiliary power source devices, there is of course no hint that some of the PWM converter devices may be switched off during coasting. There is also no hint of the first and second predetermined phase angles of the PWM carrier waves as required by the present claims. In the judgement of the Board, the skilled person cannot be expected to provide all the features of the subject-matter of any one of claims 1 to 4 which are missing in D1 on his own initiative, without any pointer towards that subject-matter.

8. The Board concludes therefore that the appellant has not shown that the subject-matter of the claims does not involve an inventive step within the meaning of Article 56 EPC and that the grounds for opposition mentioned in Article 100 EPC do not prejudice the maintenance of the patent in the form approved by the opposition division.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Sauter W. J. L. Wheeler