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D E C I S I O N
of 28 September 2000

Case Number: T 1157/98 - 3.5.2

Application Number: 95943153.7

Publication Number: 0769217

IPC: H02J 7/00

Language of the proceedings: EN

Title of invention:

Universal charging station and method for charging electric
vehicle batteries

Applicant:

Norvik Traction Inc.

Opponent:

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Headword:

-

Relevant legal provisions:

EPC Art. 123(2), 56

Keyword:

"Inventive step - yes; after amendment"

Decisions cited:

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Catchword:

-



Case Number: T 1157/98 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 28 September 2000

Appellant: Norvik Traction Inc.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 24 July 1998
refusing European patent application
No. 95 943 153.7 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: A. G. Hagenbucher
B. J. Schachenmann

Summary of Facts and Submissions

I. The appellant contests the decision of the examining division to refuse European patent application No. 95 943 153.7. The reason given for the refusal was that claims 1 and 5 then on file contravened Article 123(2) EPC and that the subject-matter of these claims was obvious having regard to

D1: US-A-5 202 617,

D2: EP-A-533 317,

D4: EP-A-314 155,

D5: EP-A-523 381 and

D6: EP-A-394 074.

II. With the statement of grounds of appeal the appellant filed new claims and amended pages of the description.

III. The Board informed the appellant that further amendment of the claims and description was necessary in order to avoid objections under Article 123(2), Article 84 and Rule 27(1)(b) and (c) EPC.

IV. Thereupon the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of

Claims: 1 to 9 (pages 19 to 21, 21a, 22 to 27)
as filed with the letter dated
6 September 2000, received 8 September
2000;

Description: pages 2, 3, 6, 14, 16 and 17 as originally filed,
pages 4, 5, 9, 13 and 13a as filed with the letter dated 16 September 1996, received 23 September 1996,
pages 1, 7, 8, 10a, 10b, 10c, 10d, 11, 15 and 18 as filed with the letter dated 6 September 2000, received 8 September 2000,
pages 9a and 12 faxed on 8 September 2000;

Drawings: Sheets 1/4 to 4/4 as published.

V. Independent claims 1 and 5 read as follows:

"1. A method of charging a battery (84) of an electric vehicle (80), where the battery is capable of accepting initial charging current at a rate greater than 1C, and where a charging station (82) from which the charging current is delivered to the battery (84) is capable of delivering that charging current at a preset voltage which is suitable for the battery being charged, comprising:

- (a) establishing a connection of lines (90, 92) between the battery (84) to be charged and the charging station (82), there being at least two wires (90) capable of carrying the maximum value of charging current to be delivered and communication means (92) capable of transferring data concerning the state of charge of the battery being charged between the battery (84) and the charging station;

(b) interrogating the vehicle from the charging station over the communication means to determine if there is present and associated with the battery in the vehicle a battery specific charging control module (86), or in the absence of a said control module (86) if there exists in the vehicle a personality module which identifies at least the criteria of maximum charging current and nominal charging voltage under which conditions the battery may be charged in the shortest possible time period, or, in the absence of either a said control module (86) or a said personality module, if there exists in the vehicle (80) at least monitoring means to determine the value of terminal voltage of the battery (84) being charged; and

(c) charging the battery (84):

(1) in the event that a battery specific charging control module (86) is present in the vehicle, by delivering charging current thereto under the control of the battery specific charging control module (86), the delivery of charging current to the battery being stopped in keeping with a signal to do so which is issued by the battery specific charging control module (86), whereafter the battery may be disconnected from the charging station (82); or

(2) in the event that a personality module which at least identifies the maximum charging current and nominal charging voltage is present in the vehicle (80), by delivering

charging current thereto initially at the maximum charging current and nominal charging voltage, periodically halting the charging current and determining the instantaneous resistance-free terminal voltage of the battery during each interval of time when delivery of charging current has been halted, and comparing the instantaneous resistance-free terminal voltage to a reference voltage which is stored in a station controller (136) which is present in the charging station (82), the charging current being reduced under control of the station controller (136), and the delivery of charging current to the battery being stopped in keeping with a signal to do so which is issued by the station controller (136), whereafter the battery may be disconnected from the charging station (82);

or

- (3) in the event that neither a said battery specific charging control module nor a said personality module is present in the vehicle, and there at least exists in the vehicle (80) monitoring means to determine the value of the terminal voltage of the battery being charged, by presetting the charging station to establish predetermined allowable values of nominal charging voltage and maximum charging current, and the charging station is further preset to establish a maximum value of charging energy to be permitted to be delivered to the battery, after which delivery of the charging current to the battery is halted

periodically and instantaneous resistance-free terminal voltage of the battery is determined during each interval of time when delivery of the charging current has been halted, and the instantaneous resistance-free terminal voltage is compared to a reference voltage which has been stored in the station controller (136), the delivery of the charging current being reduced under control of the station controller (136), and in which delivery of charging current to the battery (84) is stopped in keeping with a signal to do so which is issued by the station controller (136), or delivery of charging current to the battery is stopped when the preset maximum value of charging energy has been delivered, whereafter the battery may be disconnected from the charging station (82),

wherein, in each of steps (1), (2), and (3), the signal to stop delivery of charging current to the battery, and data which are indicative of the instantaneous terminal-voltage of the battery, are transferred between the battery (84) and the charging station (82) over the communication means (92)."

"5. A charging station for charging a battery (84) of an electric vehicle (80) where the battery is capable of accepting initial charging current at a rate greater than 1C and where the charging station (82) is capable of delivering that charging current at a preset voltage which is suitable for the battery being charged, comprising:

at least two wires (90) capable of carrying the

maximum value of charging current to be delivered to the battery;

communication means (92) capable of transferring data concerning the state of charge of the battery (84) being charged between the battery and the charging station (82);

means for charging the battery by delivering charging current thereto under the control of a battery specific charging control module in the vehicle in the event that a battery specific charging control module is present in the vehicle, and means for stopping the delivery of charging current to the battery in keeping with a signal to do so issued by the battery specific charging control module;

means for presetting the charging station to predetermined allowable values of nominal charging voltage and maximum charging current in the event that there at least exists in said vehicle monitoring means to determine the value of the terminal voltage of the battery being charged, means for presetting a maximum value of charging energy to be permitted to be delivered to said battery, means for periodically halting the delivery of charging current, means for determining the instantaneous resistance free terminal voltage of said battery during each interval of time when delivery of the charging current has been halted, means for comparing said instantaneous resistance free terminal voltage to a reference voltage stored in a station controller (136) which is present in said charging station, means for reducing the charging current under control of said station controller (136), and means for stopping the delivery of charging current to said battery; and

the signal to stop delivery of charging current, and the data which is indicative of the instantaneous

terminal voltage of the battery, being transferred between the battery (84) and the charging station (82) over said communication means (92);

characterised by means for interrogating the vehicle over the communication means (92) to determine if there is present and associated with the battery (84) in the vehicle (80) a battery specific charging control module (86), or in the absence of the said control module (86) to determine if there exists in said vehicle a personality module which identifies at least the criteria of maximum charging current and nominal charging voltage under which conditions the battery may be charged in the shortest possible time period; or in the absence of a battery specific charging module associated with said battery and the absence of a personality module which identifies at least the criteria of maximum charging current and nominal charging voltage under which conditions the battery may be charged in the shortest possible time period, to determine if there exists in said vehicle at least monitoring means to determine the value of terminal voltage of the battery being charged; and

means for charging the battery (84) by delivering charging current thereto, initially at a maximum charging current and a nominal charging voltage in the event that a said personality module which at least identifies the maximum charging current and nominal charging voltage is present, means for periodically halting the delivery of charging current and determining the instantaneous resistance free terminal voltage of the battery (84) during each interval of time when delivery of charging current has been halted, means for comparing the instantaneous resistance free terminal voltage to a reference voltage stored in the station controller (136), means for reducing the

charging current under control of said station controller, and means for stopping the delivery of charging current to the battery (84) in keeping with a signal issued by the station controller,

and in the event that monitoring means exist in said vehicle, the means for stopping the delivery of charging current to said battery does so either in keeping with a signal issued by said station controller or when said preset maximum value of charging energy has been delivered to said battery."

Claims 2 to 4 are dependent on claim 1 and claims 6 to 9 are dependent on claim 5.

Reasons for the Decision

1. The appeal is admissible.
2. The amendments made to the application documents (claims and description) comply with the requirements of Article 123(2) EPC. All the features in the present claims can be found in the original claims and description in conjunction with Figures 1 and 2. The feature "where the battery is capable of accepting initial charging current at a rate greater than 1C" has been reinserted into claims 1 and 5.
3. None of the cited documents D1, D2, D4 to D6 discloses all the features of the subject-matter defined in present claims 1 or 5. The remaining issue to be decided is whether the subject-matter of claims 1 and 5 involves an inventive step.
4. *Closest prior art and problem*

The appellant agrees with the decision under appeal that document D1 represents the most relevant prior art. Indeed, D1 discloses all the features in the preamble of claim 5.

Although document D1 describes a universal charging station at which a wide variety of electric vehicles may be charged over a wide variety of parameters (column 2, lines 58 to 61), the known charging station is a passive charging station which operates in accordance with parameters provided to it either in a manual mode or under instruction from the charge controller on board the vehicle which sends an enable signal to the charging station.

The present invention solves the problem of providing a charging station for a large variety of vehicles which may assist the charging process even if they have no on-board charge controller.

5. *Solution*

According to the present invention this problem is essentially solved by providing a charging station and method of its operation for vehicles which may have either a battery specific charging control module or a personality module which latter identifies at least the criteria of maximum charging current and nominal charging voltage under which conditions the battery may be charged in the shortest possible time period. If neither of these two facilities is available in a vehicle, a manual mode is chosen with specified limits of charging voltage, current and power. Unlike the system disclosed in D1, the charging station of the present invention itself interrogates the electric

vehicles in a particular order to determine the optimum charging control for the respective vehicle in dependence on the available facilities.

6. There is no hint in the cited prior art for designing a charging station which interrogates the vehicles to find out whether they have either a battery specific charging control module or a personality module. The charging station disclosed in D1 is a passive charging station which operates in accordance with parameters provided to it, either in a manual mode or under instruction from a charge controller provided on board the vehicle to be charged when an enable signal is sent from the on-board controller to the charging station. This does not constitute an interrogation of the vehicle by the station controller.

7. Document D2 describes a number of distinct charging systems each being suitable for vehicles with only one specific charging facility. Figure 20 of D2 discloses a charging station for vehicles having an on-board charging controller but no other facilities. The charging station waits to receive control instructions from the on-board charge controller of the vehicle. Figure 26 of D2 shows a charging station for vehicles with means for storing and outputting "vehicle information" representative of the type of electric power system or battery. The charging station then controls the charging current and voltage based on particular vehicle information. The storage of such a "vehicle information" is similar to the function of the personality module of the present invention. Document D2 does not combine both charging systems, nor hint at providing a charging station which can deal with vehicles having arbitrarily an on-board battery

specific charging control module or a personality module. Figures 29 and 30 show a charging station with a generally manual input, for example a bar-code reader. In all examples the charging station is passive and waits for external instructions to control the charging parameters.

8. Documents D4 to D6 relate to fields which are very different from that of batteries for electric vehicles and their charging.

D4 concerns a system for charging a plurality of Ni-Cad batteries and D5 a system for charging different sealed batteries according to their known charging parameters by using a battery specific card which is selected by a user. Document D6 relates to the determination of a state of a rechargeable battery in a portable electronic device, for example a mobile telephone.

9. In view of the following essential features of the subject-matter of the present claims 1 and 5:

- (a) charging station is significantly more versatile than the prior art station of D1 because it is designed for working in three different ways in dependence on at least three different types of charging equipment in the particular vehicles,
- (b) charging station actively interrogates vehicles regarding their kind of equipment (master function, not slave function as in D1) in order to determine the optimum charging control and
- (c) specified order of charging preferences

the Board is of the opinion that the subject-matter of present claims 1 and 5 is not obviously derivable even from a combined consideration of the cited documents.

Hence, the subject-matter of claims 1 and 5 shall be considered as involving an inventive step within the meaning of Article 56 EPC.

10. In the opinion of the Board, independent claims 1 and 5, together with the dependent claims 2 to 4 and 6 to 9 are allowable. The amended application documents meet the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent as requested (see paragraph IV above).

The Registrar:

The Chairman:

M. Hörnell

W. J. L. Wheeler