Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 11 November 2020

Case Number: T 0123/20 - 3.2.01

Application Number: 14806922.2

Publication Number: 3006247

IPC: B60K6/48, B60K6/543, B60L11/14, B60W10/02, B60W20/00, F16H61/12, F16H61/662

Language of the proceedings: EN

Title of invention:
MALFUNCTION DETERMINATION DEVICE AND MALFUNCTION DETERMINATION METHOD FOR HYBRID VEHICLE

Applicant:
NISSAN MOTOR CO., LTD.
JATCO Ltd

Headword:

Relevant legal provisions:
EPC Art. 83, 56

Keyword:
Sufficiency of disclosure - (yes)
Inventive step - main request (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 0123/20 - 3.2.01

D E C I S I O N
of Technical Board of Appeal 3.2.01
of 11 November 2020

Appellant: (Applicant 1)	NISSAN MOTOR CO., LTD. 2 Takara-cho Kanagawa-ku Yokohama-shi, Kanagawa 221-0023 (JP)
Appellant: (Applicant 2)	JATCO Ltd 700-1, Imaizumi Fuji-shi, Shizuoka 417-8585 (JP)
Representative:	Osha Liang 2, rue de la Paix 75002 Paris (FR)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 31 July 2019 refusing European patent application No. 14806922.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Pricolo
Members:	A. Wagner
	P. Guntz

Summary of Facts and Submissions

I. The appeal was filed by the appellant (applicant) against the decision of the examining division to refuse the patent application in suit.

II. In the decision under appeal the examining division concluded that the main request, filed on 5 December 2016, and the auxiliary requests 1 and 2, both filed on 3 May 2019, contravened the requirements of Article 83 EPC.

III. During examination proceedings, the examining division also raised objections under Article 56 EPC against independent device claim 1 and independent method claim 6 of the main request in view of the teaching of documents

D1: JP 2012 090491

D10: US 2012/078457

in combination with general knowledge as for example disclosed in the documents

D11: EP 1 887 244 A2 or

D12: EP 1 975 445 A2.

IV. In reply to a telephone conversation the appellant requested with letter dated 3 November 2020 that the contested decision be set aside and that a patent be granted on the basis of the application documents according to the main request or one of the first and second auxiliary requests filed therewith. The claims

of these requests correspond to the claims of the respective requests underlying the contested decision, the only difference being that they are not drafted in the two-part form. In reply to an earlier phone conversation, the applicant filed with letter dated 6 October 2020 an adapted description.

V. Claim 1 of the main request is identical to the originally filed claim 1 except for the reference signs and reads as follows (numbering of features (i) and (ii) added by the Board):

A failure determination device of a hybrid vehicle (100) including an engine (1) and a motor (3) arranged in series, a clutch (6) arranged between the motor and a driving wheel (8), and a pressure adjusting mechanism for adjusting hydraulic pressure supplied to the clutch (6), and performing, by the pressure adjusting mechanism, wet start clutch control for adjusting the hydraulic pressure, supplied to the clutch (6) at least upon starting, to the hydraulic pressure causing the clutch to slip, the failure determination device comprising:

target torque capacity calculating means adapted to calculate required driving force on the basis of accelerator opening, and calculate torque capacity of the clutch (6), required for transmitting the required driving force by the clutch, as target torque capacity (Tc);

actual torque calculating means adapted to calculate actual torque (Te) of the engine (1) and actual torque (Tm) of the motor (3);

(i) torque deviation calculating means adapted to calculate a torque deviation as a deviation between the target torque capacity (Tc) and a sum of the actual

torque (Te) of the engine (1) and the actual torque (Tm) of the motor; and
(ii) failure determining means adapted to determine occurrence of an engagement failure of the clutch (6) when the torque deviation becomes greater than a fault determination value (δ1) during the wet start clutch control.

Claim 6 of the main request is identical to the originally filed claim 6 except for the reference signs and reads as follows (numbering of features (i)and (ii) added by the Board):

A failure determination method of a hybrid vehicle including an engine (1) and a motor (3) arranged in series, a clutch (6) arranged between the motor and a driving wheel (8), and a pressure adjusting mechanism for adjusting hydraulic pressure supplied to the clutch (6), and performing, by the pressure adjusting mechanism, wet start clutch control for adjusting the hydraulic pressure, supplied to the clutch (6) at least upon starting, to the hydraulic pressure causing the clutch to slip, the failure determination method comprising:
a target torque capacity calculating step (S4) for calculating required driving force on the basis of accelerator opening, and calculating torque capacity of the clutch (6), required for transmitting the required driving force by the clutch, as target torque capacity (Tc);
an actual torque calculating step (S3) for calculating actual torque (Tc) of the engine (1) and actual torque (Tm) of the motor;
(i) a torque deviation calculating step (S6) for calculating a torque deviation as a deviation between the target torque capacity (Tc) and a sum of the actual

torque (Te) of the engine and the actual torque (Tm) of the motor; and

(ii) a failure determining step (S6) for determining occurrence of an engagement failure of the clutch (6) when the torque deviation becomes greater than a first fault determination value (81) during the wet start clutch control.

Reasons for the Decision

1. **Sufficiency of disclosure - Article 83 EPC**

1.1 The Board judges that the application fulfills the requirements of Article 83 EPC.

1.2 The examining division argued that a torque deviation between the target torque capacity Tc and a sum of the actual torque of the engine Te and the actual torque of the motor Tm in feature (i) (see paragraph [0045] of the description) could have different causes in addition to an engagement failure of the clutch in accordance with the definition of the claim (this clutch will be hereinafter referred to as "second clutch"). These causes were (decision point 11.1)

A) an engine or motor failure, or

B) an engine or motor torque estimation error made in step S3 of Fig. 3.

Furthermore a non-detection of an engagement failure of the second clutch would be possible in case of

C) a clutch engagement failure of the clutch arranged between the engine and the motor (hereinafter referred

to as "first clutch") (decision point 11.2).

Since the skilled person was not able to distinguish whether a torque deviation was caused by a second clutch failure, as desired, or was rather due to any of the other causes mentioned above, and also, the skilled person did not know how to avoid said non-detection, the invention was not sufficiently disclosed.

1.3 In accordance with established case law, the question of sufficiency of disclosure has to be assessed on the basis of the application as a whole, which should enable the skilled person in the art to rework the invention as defined in the claims.
Considering that the figures together with the description, paragraphs [0013-0074], disclose in a clear and comprehensible manner an embodiment of the claimed device and of the claimed method, the Board concludes that the skilled person would have no difficulties in carrying out the invention as claimed.

1.4 In fact, the Board takes the view that the arguments of the examining division are not directed to the question of whether a skilled person can carry out the invention, but rather to the question of whether the claimed device and method allow to reliably determine an engagement failure of the clutch. Even if the determination of an engagement failure during the wet start clutch control (WSC control) is not 100% accurate or is not always reliably determined, this does not imply that the invention is insufficiently disclosed.

1.5 As correctly pointed out by the appellant, the invention can at least be carried out under the general assumption that the other components operate correctly. The invention is about failure detection of one of the

components, not about multiple components failure (which might well impair failure detection of said one component).

1.6 Concerning cause A the Board agrees with the argument of the appellant that the problem of engine failure and motor failure has to be seen separately from the problem of clutch engagement failure (ground of appeal, page 2, paragraphs 1-4, page 3, paragraph 6). The invention does not deal with a fail-safe system for detecting an engine or motor failure. The problem of engine failure or motor failure can be addressed separately and does not necessarily need to be disclosed in an application that deals with the determination of an engagement failure of the second clutch during WSC control. The skilled person knows that the controlling of a hybrid vehicle is complex. An application dealing with one selected problem does not need to be directed to all aspects and interlinked problems of a hybrid vehicle.

1.7 Regarding cause B the appellant argued that the torque deviation caused by estimation errors is much smaller than the torque deviation caused by the second clutch failure. Such a small torque deviation could easily be considered when selecting a suitable fault determination threshold/value.
The Board considers that either the skilled person accepts that not all failure detections may be caused by engagement failure of the clutch or, as argued by the appellant, the skilled person selects a suitable fault determination threshold/value.

1.8 Regarding cause C the examining division argued (decision, point 11.2) that according to the description paragraph [0035] the engagement failure of

the second clutch (6) was the result of an insufficient hydraulic pressure supplied to said clutch. This insufficient hydraulic pressure might be caused by a reduction in line pressure. According to paragraphs [0016] and [0020] **both** the first and second clutches would be fed with the **same pressure line**. As a consequence, if the line pressure was low, both clutches might be insufficiently supplied with hydraulic pressure. Thus the first clutch would not be fully engaged and the torque could not be transferred to the motor and the second clutch. As a consequence the torque comparison (S6, Fig. 3) could lead to a non-detection of a clutch engagement failure of the second clutch.

The Board does not agree that paragraphs [0016] and [0020] disclose that both clutches would be fed with the same pressure line. Instead it is disclosed that both clutches are controlled by hydraulic pressure, which is adjusted by a hydraulic valve unit 71 based on a command from a controller 50. From paragraphs [0028, 0029] it becomes clear for the skilled person that both clutches can be controlled independently. The valve 71 controls the **line pressure** in the **different lines** leading to the clutches. For example, with EV mode, the first clutch, being a normal-open clutch, is released (no pressure) while the second clutch, also being a normal-open clutch, gets gradually engaged (pressure). Coming back to paragraph [0035] the skilled person understands that it is thus possible that a reduced line pressure is supplied to the second clutch but not to the first clutch. This means that at least under the assumption that the first clutch operates correctly, the device is suitable to detect engagement failure of the second clutch caused by a reduced line pressure.

1.9 Therefore the application fulfills the requirements of Article 83 EPC.

2. **Inventive step - main request**

2.1 The Board judges that the main request is allowable under Article 52(1) EPC.

2.2 Although the contested decision is exclusively based on insufficient disclosure (Article 83 EPC), the examining division raised objections in respect of lack of inventive step during examination proceedings. The division expressed the opinion that the subject-matter of independent claims 1 and 6 of the main request was not inventive in view of D1 with general knowledge or in view of D10 with general knowledge as disclosed in D11 or D12.

2.3 D1 is considered the **closest prior art**. D1 and D10 both refer to a control device for a hybrid vehicle. Neither D1 nor D10 is concerned with a failure determination device or a method therefore.
D1 relates to an electric vehicle control device for improving the correction accuracy of the target transmission torque capacity of the second clutch 5 at the time of WSC mode (Fig. 1, 5, paragraphs [0004, 0019, 0021] of the machine translation). Thus D1 refers to the same feature in the same drive mode as in the application.
In contrast, D10 mainly refers to other features of the drive train and is directed to power generation during an electric power generation running mode (paragraphs [0022, 0023, 0058]) of the hybrid vehicle.

2.4 The Board agrees with the finding of the examining division that claim 1 is new over D1. Contrary to the

opinion of the examining division claim 1 **differs** from D1 not only in feature (ii), but additionally at least in feature (i) and in that the control device is a failure determination device (designation of claim 1).

2.4.1 The teaching of D1 concerns the torque capacity of the second clutch. However D1 is rather directed to a target torque capacity calculating means and a method therefor than to a clutch failure determination device or failure determination method. Therefore the two-part form for claim 1 or claim 6 is not appropriate.

2.4.2 D1 teaches that the transmission torque capacity control of the clutch must be performed with high accuracy. Ideally, the target motor torque corresponds to the torque capacity of the clutch. However, the actual motor torque often does not correspond to the target motor torque (paragraph [0004, 0007, 0064]). A correction value is set, based on the deviation of target motor torque and actual motor torque. As shown in step S1 of Figure 11 (see paragraphs [0052, 0053, 0056] or paragraph [0077] of the machine translation), the process applies when the vehicle is in electric vehicle mode or "EV mode".

2.4.3 The examining division considered the control unit 403 (D1, paragraph [0056]) as torque deviation calculation means according to feature (i). Said control unit calculates the deviation between a target motor torque Tin, corresponding to the target clutch torque capacity Tc, see paragraphs [0064, 0065]) and an estimated (actual) motor torque rTin (paragraphs [0041, 0056]) **without** considering the actual torque of the engine. The deviation is used to calculate a correction amount.

2.4.4 The torque deviation calculation occurs when the vehicle is in electric vehicle mode or "EV mode". In the EV mode, the wheels are driven only by the driving force of the motor generator 2. In other words, in the EV mode, the vehicle engine 1 does not run and the actual engine torque is **not** considered, see D1, paragraph [0039, 0040] with paragraph [0045] and in particular paragraph [0046] (*"The torque correction amount calculation unit 402a calculates a torque correcting amount based on the estimated motor torque obtained from an inverter output current value, hydraulic oil temperature, and a torque corrected amount calculation map. Here, a torque correction amount is a correction amount with respect to the target transmission torque capacity CL2 of the 2nd clutch 5 set based on the input torque to the 2nd clutch 5 for which it is substituted by a estimated motor torque."*).
Therefore feature (i) is not disclosed in D1.

2.5 The **technical effect** of the distinguishing features (i) and (ii) is the comparison of a torque deviation with a fault determination value to detect a clutch engagement failure during the WSC control.

2.6 The **objective technical problem** can be considered as providing a failure determination device and a failure determination method for the second clutch.

2.7 Concerning feature (ii), the **examining division** argued that these features were obvious for a skilled person starting from D1 because he would base a clutch diagnostics on available parameters. As the torque deviation means 403 calculated the torque deviation according to feature (i), it would be obvious to check the plausibility of said value by comparing it to a

fault determination value.

2.8 The **Board** points out that D1 does not provide any teaching that **would** (not only **could**) have prompted the skilled person, faced with the technical problem of determining a clutch engagement failure, to modify or adapt the device of D1, thereby arriving at the invention recited in claim 1.

2.8.1 There is no hint for the skilled person to select from all possible technical failures in a hybrid drive the problem of clutch engagement failure during WSC control.

2.8.2 Even if the skilled person would try to find a solution to the problem, he would not be prompted to use the torque deviation according to feature (i). As illustrated in figure 1, the device of D1 is provided with an input rotation speed sensor 12 and an output rotation speed sensor 13 located upstream/downstream of the second clutch 5. Thus, if the engagement failure of the second clutch 5 had to be determined, the skilled person would calculate a difference in rotation speed at the second clutch 5 based on the signals from the two rotation speed sensors 12 and 13 and would use this value for determining the engagement failure of the second clutch 5. As mentioned in paragraph [0005] of the present application, such a solution for determining a clutch engagement failure is commonly used. The presence of the rotation speed sensors 12 and 13 in D1 would have prompted the skilled person to use such a solution based on differential rotation speed in particular as the deviation between the target torque capacity and the actual motor torque already is used for calculating a first corrected amount (D1,

paragraphs [0040, 0046]).

2.8.3 Therefore, the Board judges that the subject matter of claim 1 is inventive in view of D1 combined with general knowledge. The same arguments are applicable for method claim 6.

3. Further remarks

3.1 Even starting from D10 the skilled person would neither be prompted to select the specific problem of an engagement failure of the clutch C1 nor hinted at modifying the control device for the power generation in such a way as to determine the engagement failure. D10 does not indicate that the clutch C1 is of particular importance.

3.2 D11 and D12 disclose methods of clutch failure diagnostics using torque plausibility checks (D11, paragraphs [0015-0017, 0035-0040] with fig. 1, 2; D12, paragraphs [0049, 0063-0069] with fig. 4). The Board takes the view that a skilled person starting from D1 or D10, both dealing with very specific problems of a hybrid vehicle, would not just combine the complex control devices or methods developed to solve a specific problem in a specific mode with a control device or method according to D11 or D12.

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 an European patent on the basis of the the following documents according to the main request:

- Claims 1-6 (main request)	filed 3 November 2020
- Description page 1	filed 5 December 2016
- Description page 3	filed 6 October 2020
- Description pages 2,4-17	as originally filed
- Description page 18	filed 26 November 2015
- Figures, pages 1/5-5/5	as originally filed

The Registrar: The Chairman:

D. Magliano G. Pricolo

Decision electronically authenticated