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D E C I S I O N
of 16 December 1999

Case Number: T 0356/97 - 3.2.4

Application Number: 90902394.7

Publication Number: 0408767

IPC: F02D 29/02

Language of the proceedings: EN

Title of invention:
Engine Output Controller

Patentee:
Mitsubishi Jidosha Kogyo Kabushiki Kaisha

Opponent:
Robert Bosch GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - yes"

Decisions cited:
-

Catchword:
-



Case Number: T 0356/97 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 16 December 1999

Appellant:
(Opponent) Robert Bosch GmbH
Postfach 30 02 20
70442 Stuttgart (DE)

Representative: Müller, Georg
Robert Bosch GmbH
Postfach 30 02 20
70442 Stuttgart (DE)

Respondent:
(Proprietor of the patent) Mitsubishi Jidosha Kogyo Kabushiki Kaisha
33-8, Shiba 5-chome
Minato-ku
Tokyo 108 (JP)

Representative: Kirkham, Nicholas Andrew
Graham Watt & Co.
Riverhead
Sevenoaks
Kent TN13 2BN (GB)

Decision under appeal: Interlocutory decision of the Opposition Division
of the European Patent Office posted 4 February
1997 concerning maintenance of European patent
No. 0 408 767 in amended form.

Composition of the Board:

Chairman: C. A. J. Andries
Members: H. A. Berger
C. Holtz

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal, received on 2 April 1997, against the interlocutory decision of the opposition division, dispatched on 4 February 1997. The appeal fee was also paid on 2 April 1997. The statement setting out the grounds of appeal was received on 4 June 1997.

Opposition was filed against the patent as a whole and based on Article 100(a) EPC.

II. In the appeal proceedings the following prior art documents were considered by the appellant to be relevant and were discussed during the oral proceedings held on 16 December 1999:

D1: US-A-4 682 667

D3: EP-A-287 862

D4: WO-A-87/02629 (with a translation into English filed with the letter of 17 November 1999)

During the oral proceedings the respondent (patentee) submitted a set of new claims 1 to 6 and an amended description.

III. Claim 1 reads as follows:

"An engine output control apparatus suitable for use in a vehicle, said vehicle being equipped with an engine output adjusting means (6) for adjusting an output of an engine and an engine output control means (7, 90) for controlling said engine output adjusting means (6) based on one of a first target amount of control corresponding to an amount of operation of a manually

operated member (20), a second target amount of control required to have wheel slippage ceased, and a third target amount of control required to permit constant-speed running of the vehicle, wherein the first, second and third target amounts of control are all of the same parameter, being engine output torque or engine drive shaft torque, and the engine output control apparatus comprises:

a first target-amount-of-control setting means (30C, 30D) for setting the first target amount of control (Tet_1 , Twt_1);

a second target-amount-of-control setting means (40C, 40D) for setting the second target amount of control (Tet_2 , Twt_2);

a third target-amount-of-control setting means (50C, 50D) for setting the third target amount of control (Tet_3 , Twt_3);

a target-amount-of-control selecting means (73C, 73D) for selecting one of said first, second and third target amounts of control according to an operation mode of the vehicle; and

an amount-of-control-of-engine-output setting means (70C, 70D) for setting an amount of control of engine output (θ_t),

wherein said engine output control means (7, 90) controls said engine output adjusting means based on the amount of control of engine output (θ_t) set by the amount-of-control-of-engine-output setting means (70C, 70D) and the target amounts of control are used as

target values to be obtained by controlling said engine output adjusting means (6) and the amount-of-control-of-engine-output is based on the target amount of control selected by said target-amount-of-control-selecting means (73C, 73 D) required to make the engine output approach said selected target value of engine output."

IV. The appellant (opponent) is of the opinion that document D3, in particular the embodiment of Figures 16-I, 16-II and 17 A,B, discloses all features of claim 1 except for a third target amount of control required to permit constant-speed running of the vehicle and the features related thereto. Although the slip control according to Figures 16-I and 16-II is divided in a first (A) and a second control step (B) this would not be of importance with regard to claim 1 since both steps are part of the slip control, and according to the general definition of claim 1 of the impugned patent the second target amount of control is an amount to cause wheel slippage to cease. The appellant maintains that Figure 16-II clearly shows that the slippage target amount of control (TOM') is delivered to a target-amount-of-control selecting means (10) in which the target amounts of control, i.e. the first target amount of control (TOM) corresponding to an amount of operation of a manually-operated member and the second target amount of control (TOM') related to the wheel slippage, are selected according to an operation mode of the vehicle. Except for constant speed drive target torque the selecting means of document D3 is the same as defined in claim 1 of the impugned patent, since the second target amount of control TOM' for the step B would always be calculated, not only during slippage. In modern vehicles the provision of constant cruise speed control is normal practice and it is obvious, in the opinion of the appellant, to combine this constant speed control with

the control system of document D3. The appellant further alleges that the skilled person dealing with the problem of providing constant speed drive would select the same parameter, i.e. engine output torque, as already used for the first and second target amounts of control in document D3 in order to avoid complication in the control system, and all the more so as it is already known to control constant speed drive on the basis of engine torque, as disclosed in document D4.

The appellant further takes document D1 into account as a relevant document, since this document discloses an engine output control apparatus for controlling an engine output adjusting means (throttle valve, see column 6, lines 5 to 9) based on one of a first target amount of control corresponding to an amount of operation of a manually operated member, a second target amount of control required to have wheel slippage ceased (column 12, lines 25 to 28), and a third target amount of control required to permit constant-speed running of the vehicle (column 6, lines 26 to 33). The appellant maintains that all three target amounts of control are of the same kind, i.e. air flow control, and a target-amount-of-control selecting means would select one of the first, second and third target amounts of control according to an operation mode of the vehicle. Since according to column 15, lines 8 and 16, it is proposed to use the reduction ratio of the transmission instead of the air flow (throttle opening degree) it is obvious to consider as the common target amounts of control the engine output and therefore engine torque.

The appellant is of the opinion that the apparatus of claim 1 therefore is not inventive.

V. The respondent (patentee) has explained the target-amount of control selecting means of claim 1, pointing out that the first, second and third target amounts of control set by the setting means are continuously delivered to the selecting means and are always present therein for selection according to the operation mode of the vehicle. The prior art, however, discloses that the operation mode is first selected and that the target amount of control is then set on the basis of the operation mode. Furthermore, none of the prior art documents gives any hint to provide selecting means for selecting one of three target amounts of control present in the selecting means and it is not obvious to use the engine output torque or the engine drive shaft torque as the common parameter for all three target amounts of control. Usually in the constant speed drive control system the difference between the target speed and the actual vehicle speed is determined and the engine input is directly controlled on the basis of this difference in a closed loop control system with feedback.

The apparatus of claim 1 therefore is inventive in the opinion of the respondent.

VI. *Requests*

The appellant (opponent) requests that the decision under appeal be set aside and the patent be revoked.

The respondent (patentee) requests that the decision under appeal be set aside and that the patent be maintained on the basis of the following documents:

Claims: 1 to 6 submitted in the oral proceedings on 16 December 1999;

Description: Columns 1 to 36 with pages to be inserted,
as submitted in the oral proceedings on 16
December 1999;

Figures: 1 to 20 as granted.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments*
- 2.1 Claim 1:

Claim 1 is presented in the one part form comprising in addition to the features of the granted claim 1 the following features (bold letters):

"wherein the first, second and third target amounts of control are all of the same **parameter, being engine output torque or engine drive shaft torque,**" and

"and the amount-of-control-of-engine-output is based on the target amount of control selected by said target-amount-of-control-selecting means (73C,73D) **required to make the engine output approach said selected target value of engine output**".

These added features are disclosed in the originally filed application with regard to the embodiment of Figures 12 to 15 [Tet], described on page 40 and following pages; and the embodiment of Figures 16 to 20 [Twt], described on page 54 and following pages (see

the published patent, column 20, embodiment of Figures 12 to 15; column 27, embodiment of Figures 16 to 20). They are also disclosed in the original and granted claims 6 and 8.

It has furthermore been unequivocally clarified in the wording of claim 1 that the controlling of the engine output adjusting means is based on one of the three target amounts of control (instead of "on at least one" of them).

The protection conferred by granted claim 1 is limited by the additional features of the new claim 1.

2.2 Claims 2 to 6:

Claims 2, 3, 4 to 6 are based on the granted claims 2, 3, 7, 9 and 10.

2.3 Description:

In the amended description the prior art is taken into account. The first and second embodiments are indicated to be only present for the purpose of explanation as they are no longer part of the protection sought in claim 1.

2.4 The claims, description and drawings do not contravene Article 123 EPC.

3. *Novelty*

None of the cited prior art documents discloses a control apparatus with all the features of claim 1. The subject-matter of claim 1 therefore is new in the meaning of Article 54 EPC.

4. *Closest prior art*

The appellant has considered each of documents D3 and D1 as potentially the most relevant prior art document.

The board will therefore discuss these documents separately as a possible starting point in the evaluation of inventive step.

5. *Problem and solution*

5.1 Problem:

Regardless of whether document D1 or D3 is taken as the starting point, the technical problem underlying the invention is to provide a control apparatus of the type allowing accelerator-by-wire control, traction control and auto-cruise control all to be performed by the apparatus without complication of the controls (column 2, lines 8 to 13) and with which high accuracy control can be obtained.

5.2 Solution:

By the three target amounts of control being of the same parameter, i.e. engine output torque or drive shaft torque; by being provided with selecting means for selecting one of said target amounts of control according to an operation mode of the vehicle, and by controlling the engine output adjusting means (for instance throttle valve) on the basis of this selected target value the control system is simplified and the accuracy of its operation is improved.

6. *Inventive step*

6.1 Document D3 discloses a traction control apparatus for vehicle engines for preventing the wheel of a vehicle from slipping during acceleration. According to this apparatus a first target torque amount TOM (page 10, line 10) based on an amount of operation of the accelerator pedal (page 9, lines 53 to 58) and a second target torque amount (slip target torque amount) TOM' (page 11, lines 28 to 30 and 44 to 48) are determined and one of these target torque amounts TOM, TOM' is delivered to the throttle opening setting means (31) by the switching means 10 (page 11, line 30) for normal drive (TOM) or for slip mode (TOM') (Figures 16-I, 16-II, control blocks 24, 9). The opening degree of a throttle valve (35) is set to eliminate the difference between the target torque and the actual torque.

However, the essential feature of this control apparatus, which therefore cannot be neglected in the control circuit, is the two step slippage control in which during the first step (A) the engine output torque is largely decreased to immediately decrease the slip of vehicle wheels and during the second step (B), an engine output according to a friction coefficient between a road surface and the tire is output (page 2, lines 13 to 24). When slip occurs, engine output rate K_0 smaller than an engine output required through an acceleration pedal is supplied to the engine output control means as instruction A to greatly decrease the engine output, thereby stopping the slip quickly. Then, engine output rate K_1 which is larger than K_0 and can provide sufficient road surface torque T_r is supplied to the engine output control means. Therefore, when slip is stopped, an engine output high enough to drive wheels can be obtained, and the vehicle can be smoothly accelerated without causing slip. According to the flow chart in Figure 17A the engine output rate K_1 is

calculated on the basis of engine output rate K0 (step B2) after the occurrence of slippage (steps A2 and A3) or is set to be 1 when no slippage occurs (step A1). Slip target torque TOM' is calculated with this output rate K1 (see page 11, line 29). However, the slip target torque TOM' as the second target-amount-of control can only be selected by the switching means 10 (Figure 16-II) firstly after slip has been determined (step A2), secondly after the torque output already has been reduced considerably (step A6) in the first control step based on instruction A, and thirdly after instruction B has been outputted (step B3) towards the TOM' calculating means 9.

Indeed, it is only after instruction B has been outputted, that means after a part of the slippage has already been reduced, that the value TOM' is calculated (in box 9). Before this calculation, but after detection of occurring slippage there is no value TOM' present which could be selected.

Although it can be accepted that the switching means 10 indeed "selects" at a certain moment a value TOM or TOM' according to a vehicle operation mode, the board is not convinced that these values are always available for selection, particularly since the value TOM' only becomes available (is calculated) under above mentioned specific conditions, and not under all conditions as presently claimed.

According to the statement of the respondent (also see Figure 15, steps S301, S102; Figure 20, steps S401, S102 of the patent), the first, second and third target amounts of control are however first calculated and are always present for being selected in the target-amount-of-control selecting means of claim 1, according to the operation mode of the vehicle.

6.2 It might be that the skilled person would take into account a combination of constant speed drive control with the control system of document D3. However, there is no hint given, firstly to select constant speed drive control functioning on the basis of output torque or drive shaft torque, since usually constant speed drive control is established by a closed loop system with the feedback value based on the difference between the target vehicle speed and the actual vehicle speed, and secondly to change the switching means (10) of the apparatus of document D3 into selecting means for selecting one of three, always present, target amounts of control, included the third target amount of control based on constant speed drive, instead of a system wherein the particular operation mode is determined first, and wherein thereafter the one target amount corresponding to the said operation mode of the vehicle is taken into account. Although document D4 (see translation into English) discloses constant speed drive control on the basis of engine output torque there is nothing indicated which would lead the skilled person to use this parameter also in combination with a first target amount of control corresponding to an amount of operation of a manually-operated member let alone to use it again in combination with a second target amount of control for stopping slippage.

Documents D3 and D4 therefore cannot lead to the control apparatus of claim 1.

6.3 Document D1 discloses an engine output control apparatus for a vehicle, said vehicle being equipped with an engine output adjusting means (throttle, see column 6, lines 5 to 9) for adjusting an output of an engine, and an engine output control means (1000, signal 220) for controlling said engine output adjusting means (throttle actuator, see column 6, lines 9 to 11) based on at least one of a first target

amount of control corresponding to an amount of operation of a manually operated member (column 6, lines 12 to 22), a second target amount of control required to have wheel slippage ceased (Figure 7; blocks 6305 to 6307; column 11, lines 26 to 36; column 12, lines 26 to 31, 44 to 50; column 13, lines 19 and following), and a third target amount of control required to permit constant-speed running of the vehicle (column 6, lines 26 to 34; column 14, lines 28 to 35).

However, the first, second and third target amounts of control are all defined by the degree of opening the throttle valve and hence not directly related to the engine output torque or the drive shaft torque. Although in column 15, lines 12 to 16 it is indicated that instead of correcting the air flow, the reduction ratio of the transmission may be corrected, there is no information given that this is the case for all three target amounts of control. This other possibility is only described in connection with slip control. Moreover, nothing is disclosed about the use of engine output torque or the engine drive shaft torque as a common parameter. Furthermore, no selecting means in the meaning of claim 1 are provided. In the prior art apparatus first the operation mode is detected and then the signals are established for this operation mode. The apparatus of claim 1 therefore cannot be derived from the document D1, neither alone nor in combination with documents D3 and D4.

6.4 Therefore, the engine output control apparatus of claim 1 is inventive in the meaning of Article 56 EPC.

7. Claim 1, as well as claims 2 to 6, the description and the drawings therefore can form the basis for the maintenance of the patent as amended (Articles 52 and 102(3) EPC).

Order

For these reasons it is decided that:

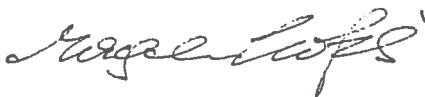
1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent in accordance with the respondent's request, i.e.

Claims: 1 to 6 submitted in the oral proceedings on 16 December 1999;

Description: Columns 1 to 36 with pages 2, 7 to 9 and 25 to be inserted, as submitted in the oral proceedings on 16 December 1999;

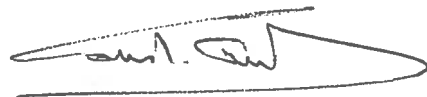
Figures: 1 to 20 as granted.

The Registrar:



G. Magouliotis

The Chairman:



C. Andries

By Gm

