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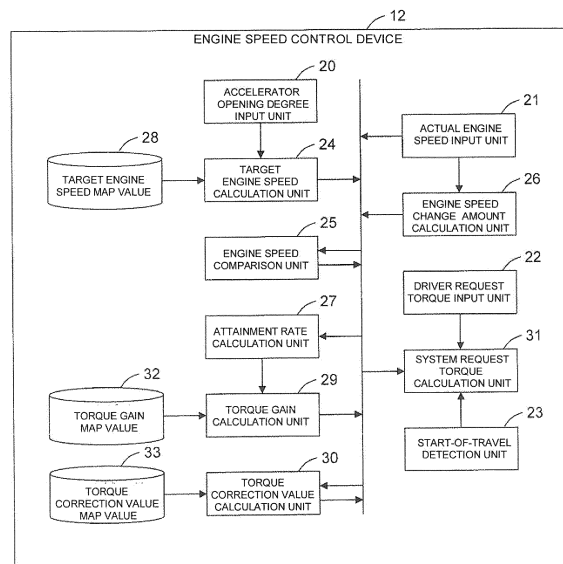
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(54) **ENGINE ROTATION SPEED CONTROL DEVICE**

(57) An engine speed control device includes a target engine speed calculation unit that calculates a target engine speed in accordance with an accelerator opening degree of a vehicle, a torque gain calculation unit that calculates a torque gain, on the basis of a change amount of an actual engine speed and an attainment rate of the actual engine speed to the target engine speed, and a

system request torque calculation unit that calculates system request torque on the basis of a value obtained by multiplying driver request torque by the torque gain. The system request torque which is calculated in this way is requested to be outputted from an engine of the vehicle, and control of the engine speed is performed.

Fig. 2



Description

Technical Field

5 **[0001]** The present invention relates to an engine speed control device for controlling an engine speed of a vehicle, and particularly relates to an art of properly controlling an engine speed in accordance with pressing down on an accelerator (a driver operation).

Background Art

10 **[0002]** In general, in a vehicle equipped with a manual transmission, at the time of starting travel, a driver first presses down on a clutch pedal to bring the clutch into a disconnected state from a connected state, and thereafter, operates a shift lever to put the transmission mechanism into first gear. Subsequently, the driver gradually returns the clutch pedal to shift the clutch to a connected state from the disconnected state gradually, while pressing down on the accelerator pedal to increase the engine speed. Although at this time, the driver needs to coordinate the operation of the clutch pedal and the operation of the accelerator pedal, the operation of coordinating the clutch pedal operation and the accelerator pedal operation cannot be easily performed by all drivers. For example, when a driver strongly presses down on an accelerator pedal at the time of starting travel before the clutch completely shifts to a connected state, the engine speed is likely to increase (rev up) more than necessary, fuel efficiency is likely to be reduced, and a large load is likely to be exerted on the transmission and the clutch.

20 **[0003]** Consequently, there is proposed a control device that sets the upper limit of the engine speed when a vehicle starts to travel. However, when the engine speed is restricted under the condition that a vehicle starts forward traveling, for example, if the accelerator pedal is depressed more than necessary before the vehicle starts forward traveling (in the period until the clutch shifts to a connected state after the accelerator pedal is depressed), the engine speed increases (revs up) more than necessary, and fuel efficiency is reduced in some cases. Further, when a driver requests engine torque which is higher than usual at the time of starting travel on an uphill road, at the time of a very fast start of travel and the like, the engine speed is also restricted and drivability is reduced in some cases.

25 **[0004]** Therefore, there has been conventionally proposed a control device that enhances fuel efficiency without reducing drivability at the time of start of travel of the vehicle (refer to Patent Literature 1, for example). In the conventional control device, the engine speed upper limit value at the initial stage is determined under the condition that the vehicle speed is zero and the clutch pedal is depressed to a maximum degree. The control device determines a correction amount of the engine speed in accordance with the change amount of the accelerator opening degree, corrects the engine speed upper limit value at the initial stage with the correction amount, and gradually decreases the throttle opening degree when the actual engine speed exceeds the engine speed upper limit value after the correction.

30 **[0005]** However, in the conventional control device, the engine speed upper limit value is changed in accordance with the change amount of the accelerator opening degree, and therefore a stable engine speed cannot be kept for each accelerator opening degree. For example, even in the case where the accelerator opening degrees are the same, if the change amounts of the accelerator opening degrees are different (for example, in the case where the accelerator pedal is depressed slowly, the case where the accelerator pedal is abruptly depressed, and the like), the engine speeds are controlled to be different engine speeds. Further, in the conventional control device, control of the throttle opening degree is performed only when the actual engine speed exceeds the upper limit value (the engine speed upper limit value), so that hunting and overshoot of the engine speed are likely to occur in the vicinity of the upper limit value, and there is the problem in convergence to the target engine speed.

Citation List

Patent Literature

35 **[0006]** Patent Literature 1: Japanese Patent Laid-Open No. 2011-163233

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Summary of Invention

Technical Problem

55 **[0007]** The present invention is made in view of the above described background. An object of the present invention is to provide an engine speed control device that can optionally set a target engine speed for each accelerator opening degree, and can enhance convergence to the target engine speed.

Solution to Problem

[0008] One aspect of the present invention is an engine speed control device, and the engine speed control device is an engine speed control device for controlling an engine speed of a vehicle, and includes a target engine speed calculation unit that calculates a target engine speed that is an engine speed set as a target, in accordance with an accelerator opening degree of the vehicle, a torque gain calculation unit that calculates a torque gain, on the basis of a change amount of an actual engine speed that is a real engine speed of the vehicle, and an attainment rate of the actual engine speed to the target engine speed, and a system request torque calculation unit that calculates system request torque which is torque that is requested to be outputted from an engine of the vehicle, on the basis of a value obtained by multiplying driver request torque that is torque corresponding to the accelerator opening degree by the torque gain.

[0009] As described as follows, other aspects are present in the present invention. Accordingly, the disclosure of the invention intends to provide a part of the aspects of the present invention, and does not intend to limit the scope of the invention which is described and claimed herein.

Brief Description of Drawings

[0010]

[Figure 1] Figure 1 is a diagram explaining an outline of a vehicle which is loaded with an engine speed control device in an embodiment of the present invention.

[Figure 2] Figure 2 is a block diagram showing a configuration of the engine speed control device in the embodiment of the present invention.

[Figure 3] Figure 3 is an explanatory diagram of a target engine speed MAP value in the embodiment of the present invention.

[Figure 4] Figure 4 is an explanatory diagram of a torque gain MAP value in the embodiment of the present invention.

[Figure 5] Figure 5 is an explanatory diagram of a torque correction value MAP value in the embodiment of the present invention.

[Figure 6] Figure 6 is a flowchart for explaining an operation of the engine speed control device in the embodiment of the present invention.

[Figure 7] Figure 7 is an explanatory diagram of engine speed control (a normal time) in the embodiment of the present invention.

[Figure 8] Figure 8 is an explanatory diagram of engine speed control (an overshoot time) in the embodiment of the present invention.

Description of Embodiment

[0011] Hereinafter, detailed explanation of the present invention will be made. However, the following detailed explanation and accompanying drawings do not limit the invention.

[0012] An engine speed control device of the present invention is an engine speed control device for controlling an engine speed of a vehicle, and includes a target engine speed calculation unit that calculates a target engine speed that is an engine speed set as a target, in accordance with an accelerator opening degree of the vehicle, a torque gain calculation unit that calculates a torque gain, on the basis of a change amount of an actual engine speed that is a real engine speed of the vehicle, and an attainment rate of the actual engine speed to the target engine speed, and a system request torque calculation unit that calculates system request torque which is torque that is requested to be outputted from an engine of the vehicle, on the basis of a value obtained by multiplying driver request torque that is torque corresponding to the accelerator opening degree by the torque gain.

[0013] According to the above configuration, the target engine speed is set in accordance with the accelerator opening degree. The system request torque is calculated, on the basis of the value obtained by multiplying the driver request torque by the torque gain which is calculated on the basis of an attainment rate of the actual engine speed to the target engine speed and the change amount (the engine speed change amount) of the actual engine speed. Since the system request torque which is calculated in this way is outputted to the engine, the torque gain gradually decreases as the actual engine speed is closer to the target engine speed, and convergence to the target engine speed is enhanced. In this case, the target engine speed can be optionally set for each accelerator opening degree. Further, since the target engine speed is set for each accelerator opening degree, the target engine speed changes with a change of the accelerator opening degree, and the rotation increase request by pressing down on the accelerator (a driver operation) can be prevented from being inhibited. In this way, the engine speed can be properly controlled in response to pressing down on the accelerator (the driver operation). Accordingly, excessive revving up of the engine speed can be prevented, and drivability at the time of pressing down on the accelerator can be enhanced. Further, since the engine speed can be

controlled to a suitable engine speed at the time of pressing down on the accelerator, the transmission and the clutch can be protected, and fuel efficiency can be enhanced.

[0014] Further, the engine speed control device of the present invention may include an engine speed comparison unit that compares the actual engine speed and the target engine speed, and determines whether or not the actual engine speed is higher than the target engine speed, and a torque correction value calculation unit that calculates a torque correction value in accordance with a difference between the actual engine speed and the target engine speed, when the actual engine speed is higher than the target engine speed, and the system request torque calculation unit may calculate the system request torque by subtracting the torque correction value from the value obtained by multiplying the driver request torque by the torque gain.

[0015] According to the above configuration, in the case where the actual engine speed is higher than the target engine speed, the torque correction value is calculated on the basis of the difference between the actual engine speed and the target engine speed, and the system request torque is calculated by subtracting the torque correction value from the value obtained by multiplying the driver request torque by the torque gain. Accordingly, when the actual engine speed exceeds the target engine speed, the system request torque is made small (made negative torque, for example), whereby the engine speed can be quickly caused to converge to the target engine speed.

[0016] The engine speed control device of the present invention may include a start-of-travel detection unit that detects whether or not the vehicle has started traveling, and the system request torque calculation unit may perform calculation of the system request torque when it is detected that the vehicle has started traveling.

[0017] According to the above configuration, at the time of start of travel, the system request torque is calculated, and control of the engine speed is performed. Thereby, excessive revving up of the engine speed at the time of start of travel can be prevented, and drivability at the time of start of travel can be enhanced. Further, sudden start of travel at a high speed can be prevented, and the transmission and the clutch can be protected. Further, by starting travel at a proper engine speed, fuel efficiency can be enhanced.

[0018] According to the present invention, the target engine speed can be optionally set for each accelerator opening degree, and convergence to the target engine speed can be enhanced.

(Embodiment)

[0019] Hereinafter, an engine speed control device of an embodiment of the present invention will be described with use of the drawings. In the present embodiment, a case of the engine speed control device which is used in a vehicle or the like which is loaded with a manual transmission will be illustrated.

[0020] A configuration of the engine speed control device of the embodiment of the present invention will be described with reference to the drawings. Figure 1 is a diagram explaining an outline of the vehicle which is loaded with the engine speed control device of the present embodiment. As shown in Figure 1, the vehicle includes an engine 1, a clutch 2 and a transmission 3. The engine 1 is one of known internal combustion engines, and is, a gasoline engine using gasoline as fuel, or a diesel engine using light oil as fuel, for example. The transmission 3 is a manual transmission that has a plurality (five, for example) of forward gears, and one reverse gear, and a neutral gear. An output shaft of the transmission 3 is connected to a driving wheel 4 of the vehicle via a differential (not illustrated). Switch of the gear of the transmission 3 is carried out by a driver operating a shift lever 5. At this time, the driver also performs an operation of a clutch pedal 6 and an accelerator pedal 7.

[0021] To the transmission 3, an input rotation sensor 8 that detects a number of rotations (a number of input rotations) that are inputted to the driving wheel 4 from the transmission 3 is connected. Further, to the clutch pedal 6, a clutch stroke sensor 9 that detects an operation amount (a clutch stroke amount) of the clutch pedal 6 is connected. Further, to the accelerator pedal 7, an accelerator opening degree sensor 10 that detects an operation amount (an accelerator opening degree) of the accelerator pedal 7 is connected.

[0022] The engine 1 includes an engine ECU 11 for electronically controlling an engine operation. To the engine ECU 11, an engine speed control device 12 for controlling an engine speed is connected. Information on the number of input rotations which is detected by the input rotation sensor 8, and the clutch stroke amount which is detected by the clutch stroke sensor 9 and the like is inputted to the engine speed control device 12. Information on the accelerator opening degree which is detected by the accelerator opening degree sensor 10 is inputted to the engine ECU 11. The engine ECU 11 outputs information on a driver request torque and the like to the engine 1. To the engine ECU 11, information on actual output torque and the like is inputted from the engine 1. To the engine speed control device 12, information on an engine speed (also referred to as an actual engine speed), an accelerator opening degree, driver request torque, actual output torque and the like is inputted from the engine ECU 11. Further, information on system request torque and the like is outputted to the engine ECU 11 from the engine speed control device 12.

[0023] The clutch stroke sensor 9 is not limited to a sensor that directly detects a displacement amount of the clutch 2, but also includes sensors that can detect a moving amount of a clutch master cylinder (CMC) that operates the clutch 2, and a displacement angle or a displacement amount of the clutch pedal 6. On the basis of the information on the

above, a moving amount of the clutch 2 may be calculated by an arithmetic operation function of the engine speed control device 12.

[0024] The actual engine speed refers to a real speed (a real engine speed) of the engine 1 of the vehicle. In contrast with this, a target engine speed refers to an engine speed that is set as a target. Further, the driver request torque refers to torque that is generally obtained from an engine characteristic (MAP of the engine speed and the engine output torque) in accordance with the accelerator opening degree. Meanwhile, the system request torque refers to torque that is requested to be outputted from the engine 1 (the engine ECU 11).

[0025] Next, a configuration of the engine speed control device 12 will be described in detail. Figure 2 is a block diagram showing the configuration of the engine speed control device 12. As shown in Figure 2, the engine speed control device 12 includes an accelerator opening degree input unit 20, an actual engine speed input unit 21, a driver request torque input unit 22 and a start-of-travel detection unit 23. To the accelerator opening degree input unit 20, an accelerator opening degree (%) is inputted from the accelerator opening degree sensor 10. To the actual engine speed input unit 21, the actual engine speed (rpm) is inputted from the engine ECU 11. To the driver request torque input unit 22, the driver request torque (Nm) is inputted from the engine ECU 11. To the start-of-travel detection unit 23, the number of input rotations is inputted from the number of input rotations sensor. The start-of-travel detection unit 23 detects whether or not the vehicle has started traveling on the basis of the number of input rotations and the clutch operation. The start-of-travel detection unit 23 may detect whether or not the vehicle has started traveling on the basis of a vehicle speed (inputted from a vehicle sensor, for example).

[0026] Further, the engine speed control device 12 includes a target engine speed calculation unit 24, an engine speed comparison unit 25, an engine speed change amount calculation unit 26, and an attainment rate calculation unit 27. The target engine speed calculation unit 24 calculates the target engine speed in accordance with the accelerator opening degree of the vehicle. With reference to a target engine speed MAP value 28 as shown in Figure 3, for example, the target engine speed corresponding to the accelerator opening degree is obtained. The engine speed comparison unit 25 compares the actual engine speed and the target engine speed, and determines whether or not the actual engine speed is larger than the target engine speed. The engine speed change amount calculation unit 26 calculates a change amount (rpm/sec) of the actual engine speed. The attainment rate calculation unit 27 calculates an attainment rate (%) of the actual engine speed to the target engine speed, by using formula 1 as follows, for example.

$$\text{Attainment rate} = (\text{actual engine speed} / \text{target engine speed}) \times 100 \quad (\text{formula 1})$$

[0027] A change speed (a change time period) of the engine speed often differs depending on the engine speed in general. For example, a change time period from 4500 rpm to 5000 rpm tends to be shorter than a change time period from 1000 rpm to 1500 rpm. This is due to a characteristic of the engine that the rotation increases more easily in a high rotation region as compared with the rotation in a low rotation region. Accordingly, degrees of control significantly differ between a case where the target engine speed is 1500 rpm, and a case where the target engine speed is 5000 rpm, even when deviations of the actual engine speeds from the target engine speeds are the same (500 rpm, for example). That is, when a torque control amount for the deviation of 500 rpm is set on the supposition of quick convergence to the target engine speed of 1500 rpm from the actual engine speed of 1000 rpm, if the torque control amount is applied to the case to the target engine speed of 5000 rpm from the actual engine speed of 4500 rpm, the actual engine speed is likely to overshoot the target engine speed. Conversely, when a torque control amount for the deviation of 500 rpm is set on the supposition of quick convergence to the target engine speed 5000 rpm from the actual engine speed 4500 rpm, if the torque control amount is applied to the case from the actual engine speed 1000 rpm to the target engine speed 1500 rpm, a following time period is likely to become long, or the actual engine speed is unlikely to converge to the target engine speed. Consequently, in the present embodiment, the torque control amount is set in accordance with a ratio of the present actual engine speed to the target engine speed, and thereby, quick convergence to a target value (a target engine speed) in a wide-ranging rotation region is realized.

[0028] Further, the engine speed control device 12 includes a torque gain calculation unit 29, a torque correction value calculation unit 30, and a system request torque calculation unit 31. The torque gain calculation unit 29 calculates a torque gain on the basis of the change amount (the engine speed change amount) of the actual engine speed and the attainment rate. The torque gain is obtained from the engine speed change amount and the attainment rate, with reference to a torque gain MAP value 32 as shown in Figure 4, for example. As shown in Figure 4, a characteristic of the torque gain to the attainment rate changes in accordance with an engine speed change amount Δ . In this case, the torque gain calculation unit 29 sets a torque gain in a case where the change amount of the actual engine speed is large at a smaller value as compared with a torque gain in a case where the change amount of the actual engine speed is small.

[0029] The torque correction value calculation unit 30 calculates a torque correction value in accordance with a dif-

ference between the actual engine speed and the target engine speed when the actual engine speed is higher than the target engine speed. That is, the torque correction value calculation unit 30 calculates the torque correction value when the actual engine speed becomes the target engine speed or more. The torque correction value corresponding to the difference between the actual engine speed and the target engine speed is obtained with reference to a torque correction value MAP value 33 as shown in Figure 5, for example. When there is a speed difference between the actual engine speed and the target engine speed, the torque correction value calculation unit 30 sets the torque correction value at a larger value as the speed difference is larger. When the actual engine speed is not higher than the target engine speed, the torque correction value is zero. That is, when the actual engine speed is lower than the target engine speed, the torque correction value calculation unit 30 sets the torque correction value at zero.

[0030] The system request torque calculation unit 31 calculates a system request torque (Nm) by using formula 2 as follows, for example (that is, by subtracting the torque correction value from a value obtained by multiplying the driver request torque by the torque gain).

$$\text{System request torque} = \text{driver request torque} \times \text{torque gain} - \text{torque correction value} \quad (\text{formula 2})$$

[0031] In this way, in the present embodiment, the actual engine speed is caused to converge to the target engine speed by controlling the system request torque by using a torque gain in a base characteristic (gain control). The engine output characteristic can change due to change in loads on an air-conditioner and electric auxiliaries, and change of an outdoor temperature and atmospheric pressure, for example, but even if the base characteristic (the driver request torque characteristic) changes, the system request torque can be controlled so that the engine speed converges to the target engine speed irrespective of a variation amount of the characteristic, by performing gain control. Meanwhile, when gain control as in the present embodiment is not performed, it is also conceivable to control the system request torque by using an absolute value (a torque correction value) instead of a torque gain, for example. However, since in that case, the driver request torque is controlled with the absolute value torque (the torque correction value) which is set in advance, with respect to the target engine speed, a balance of the torque correction value and the variation amount of the characteristic is lost, and the engine speed is unlikely to follow the target value.

[0032] The system request torque which is calculated in this way is requested to be outputted from the engine 1, and is used in control of the engine speed. Control of the engine speed by the system request torque is desirably performed especially at a time of start of travel of the vehicle (when start of travel of the vehicle is detected).

[0033] An operation of the engine speed control device 12 which is configured as above will be described with reference to a flowchart in Figure 6.

[0034] As shown in Figure 6, when start of travel of the vehicle is detected by the start-of-travel detection unit 23 (S1), the engine speed control device 12 of the present embodiment acquires the accelerator opening degree from the accelerator opening degree sensor 10 (S2), and sets the target engine speed corresponding to the accelerator opening degree in the target engine speed calculation unit 24 (S3). In this case, by referring to the target engine speed MAP as shown in Figure 3, the target engine speed corresponding to the accelerator opening degree is obtained. Subsequently, the target engine speed and the actual engine speed are compared in the engine speed comparison unit 25 (S4), and when the actual engine speed is not higher than the target engine speed, the torque correction value calculation unit 30 calculates the torque correction value in accordance with the difference between the actual engine speed and the target engine speed (S5). In this case, with reference to the torque correction value MAP value 33 as shown in Figure 5, for example, the torque correction value corresponding to the difference between the actual engine speed and the target engine speed is obtained. When the actual engine speed is higher than the target engine speed, the torque correction value is zero.

[0035] In the engine speed change amount calculation unit 26, the change amount (the engine speed change amount) of the actual engine speed is calculated (S6). Further, in the attainment rate calculation unit 27, the attainment rate of the actual engine speed to the target engine speed is calculated (S7). In the torque gain calculation unit 29, the torque gain corresponding to the attainment rate and the engine speed change amount is calculated (S8). In this case, the torque gain corresponding to the attainment rate and the engine speed change amount is obtained with reference to the torque gain MAP value 32 as shown in Figure 4, for example. In the end, the driver request torque is multiplied by the torque gain in the system request torque calculation unit 31 (S9), the torque correction value is subtracted from the multiplied value (S10), and the system request torque is calculated (S11).

[0036] According to the engine speed control device 12 of the present embodiment as above, the target engine speed is set in accordance with the accelerator opening degree. The system request torque is calculated, on the basis of the value obtained by multiplying the driver request torque by the torque gain which is calculated on the basis of the attainment rate of the actual engine speed to the target engine speed and the change amount (the engine speed change amount)

of the actual engine speed. Since the system request torque which is calculated in this way is outputted to the engine 1, the torque gain gradually decreases as the actual engine speed is closer to the target engine speed, and convergence to the target engine speed is enhanced, as shown in Figure 7.

[0037] In this case, the target engine speed can be optionally set for each accelerator opening degree. Further, since the target engine speed is set for each accelerator opening degree, the target engine speed changes with a change of the accelerator opening degree, and the rotation increase request by pressing down on the accelerator (a driver operation) can be prevented from being inhibited. In this way, the engine speed can be properly controlled in response to pressing down on the accelerator (the driver operation). Accordingly, excessive revving up of the engine speed can be prevented, and drivability at the time of pressing down on the accelerator can be enhanced. Further, since the engine speed can be controlled to a suitable engine speed at the time of pressing down on the accelerator, the clutch 2 and the transmission 3 can be protected, and fuel efficiency can be enhanced.

[0038] Further, in the present embodiment, in the case where the actual engine speed is larger than the target engine speed, the torque correction value is calculated on the basis of the difference between the actual engine speed and the target engine speed, and the system request torque is calculated by subtracting the torque correction value from the value obtained by multiplying the driver request torque by the torque gain. Accordingly, as shown in Figure 8, when the actual engine speed exceeds (overshoots) the target engine speed, the system request torque is reduced (made negative torque, for example), whereby the engine speed can be quickly caused to converge to the target engine speed.

[0039] Further, in the present embodiment, at the time of start of travel, the system request torque is calculated, and control of the engine speed is performed. Thereby, excessive revving up of the engine speed at the time of start of travel can be prevented, and drivability at the time of start of travel can be enhanced. Further, sudden start of travel at a high speed can be prevented, and the clutch 2 and the transmission 3 can be protected. Further, by starting travel at a proper engine speed, fuel efficiency can be enhanced.

[0040] Although the embodiment of the present invention is described by illustration thus far, the range of the present invention is not limited to the illustration, and the present invention can be changed and modified in accordance with the object within the range described in the claims.

[0041] For example, in the above explanation, the example in which the engine ECU and the engine speed control device are configured as separate units (separate ECUs) is described, but the engine ECU and the engine speed control device may be configured as an integrated unit (a single ECU).

[0042] Although a preferable embodiment of the present invention which is conceivable at the present point of time is described above, it is to be understood that various modifications can be made with respect to the present embodiment, and the accompanying claims are intended to include all such modifications within the true spirit and the range of the present invention.

Industrial Applicability

[0043] As above, the engine speed control device according to the present invention has effects of being capable of optionally setting the target engine speed for each accelerator opening degree and being capable of enhancing convergence to the target engine speed, is applied to a vehicle or the like which is loaded with a manual transmission, and is useful.

Reference Signs List

[0044]

- 1 Engine
- 2 Clutch
- 3 Transmission
- 4 Driving wheel
- 5 Shift lever
- 6 Clutch pedal
- 7 Accelerator pedal
- 8 Input rotation sensor
- 9 Clutch stroke sensor
- 10 Accelerator opening degree sensor
- 11 Engine ECU
- 12 Engine speed control device
- 20 Accelerator opening degree input unit
- 21 Actual engine speed input unit

- 22 Driver request torque input unit
- 23 Start-of-travel detection unit
- 24 Target engine speed calculation unit
- 25 Engine speed comparison unit
- 5 26 Engine speed change amount calculation unit
- 27 Attainment rate calculation unit
- 28 Target engine speed MAP value
- 29 Torque gain calculation unit
- 30 Torque correction value calculation unit
- 10 31 System request torque calculation unit
- 32 Torque gain MAP value
- 33 Torque correction value MAP value

15 Claims

1. An engine speed control device for controlling an engine speed of a vehicle, comprising:

20 a target engine speed calculation unit that calculates a target engine speed that is an engine speed set as a target, in accordance with an accelerator opening degree of the vehicle;
 a torque gain calculation unit that calculates a torque gain, on the basis of a change amount of an actual engine speed that is a real engine speed of the vehicle, and an attainment rate of the actual engine speed to the target engine speed; and
 25 a system request torque calculation unit that calculates system request torque which is torque that is requested to be outputted from an engine of the vehicle, on the basis of a value obtained by multiplying driver request torque that is torque corresponding to the accelerator opening degree by the torque gain.

2. The engine speed control device according to claim 1, further comprising:

30 an engine speed comparison unit that compares the actual engine speed and the target engine speed, and determines whether or not the actual engine speed is higher than the target engine speed; and
 a torque correction value calculation unit that calculates a torque correction value in accordance with a difference between the actual engine speed and the target engine speed, when the actual engine speed is higher than the target engine speed,
 35 wherein the system request torque calculation unit calculates the system request torque by subtracting the torque correction value from the value obtained by multiplying the driver request torque by the torque gain.

3. The engine speed control device according to claim 1, further comprising:

40 a start-of-travel detection unit that detects whether or not the vehicle has started traveling,
 wherein the system request torque calculation unit performs calculation of the system request torque when it is detected that the vehicle has started traveling.

4. The engine speed control device according to claim 1,
 45 wherein the torque gain calculation unit sets a torque gain in a case where the change amount of the actual engine speed is large at a smaller value, as compared with a torque gain in a case where the change amount of the actual engine speed is small.

5. The engine speed control device according to claim 2,
 50 wherein the torque correction value calculation unit calculates the torque correction value, when the actual engine speed becomes the target engine speed or more.

6. The engine speed control device according to claim 2,
 55 wherein the torque correction value calculation unit sets the torque correction value at zero, when the actual engine speed is lower than the target engine speed.

7. The engine speed control device according to claim 2,
 wherein the torque correction value calculation unit sets the torque correction value at a larger value as a speed

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difference is larger, when there is the speed difference between the actual engine speed and the target engine speed.

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Fig. 1

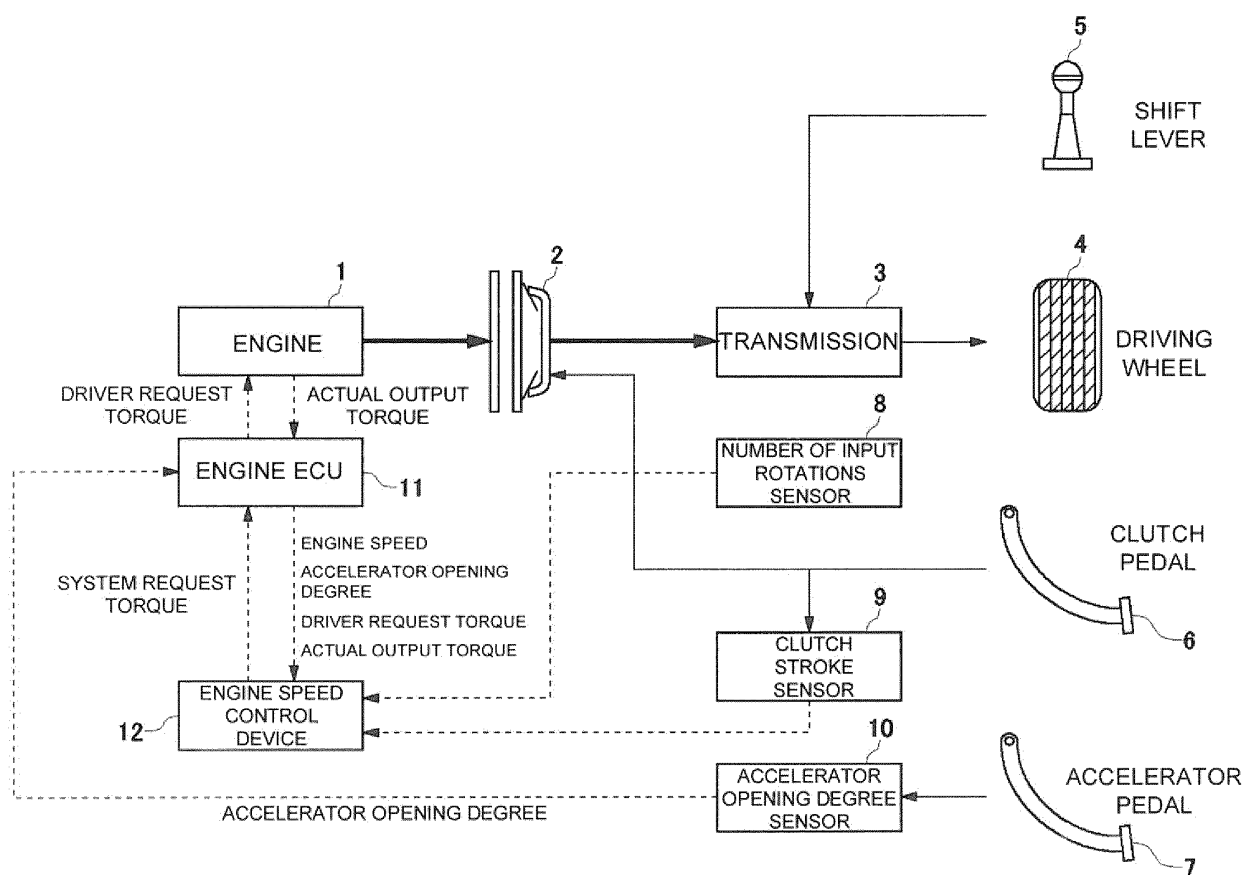


Fig. 2

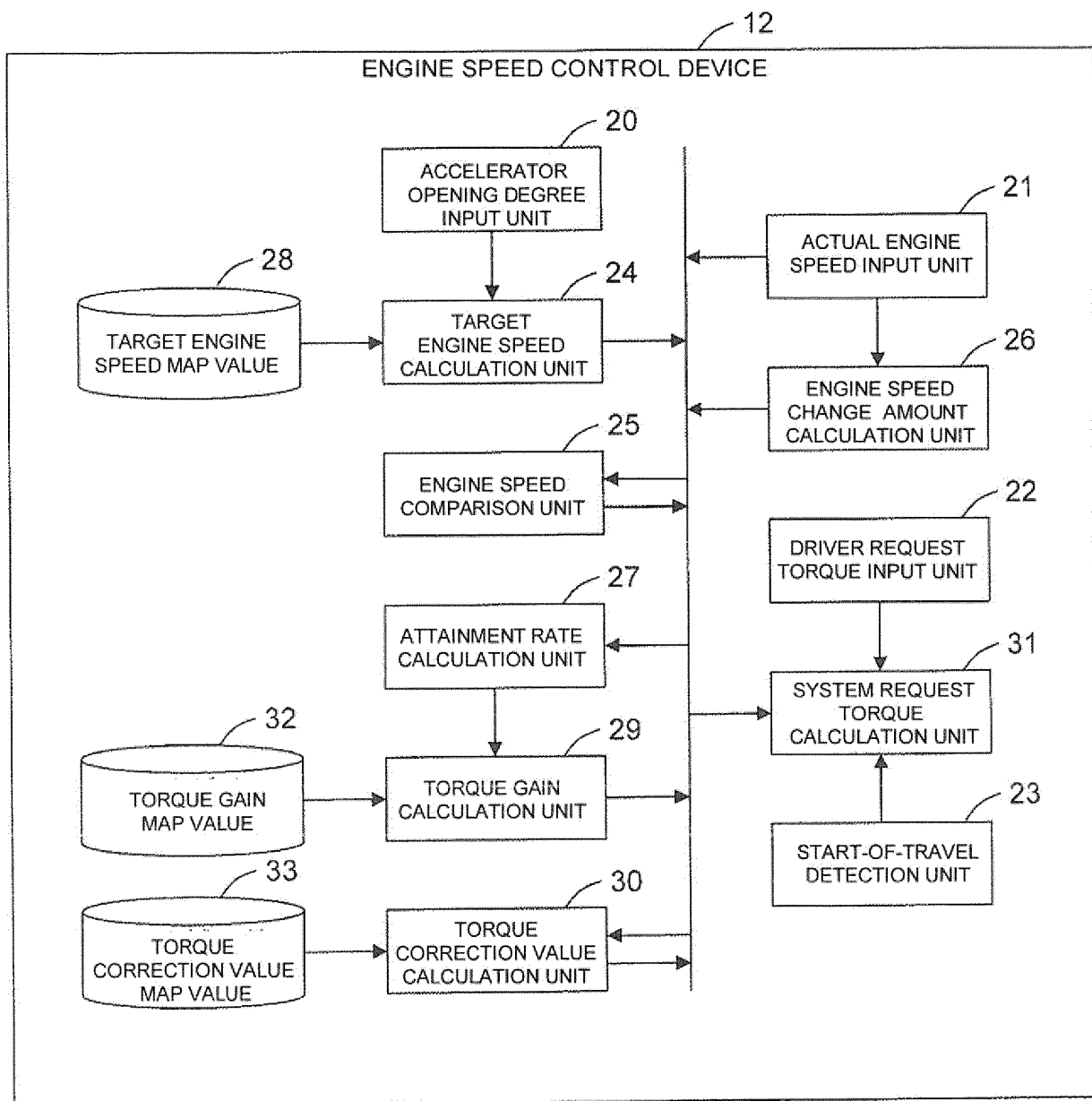


Fig. 3

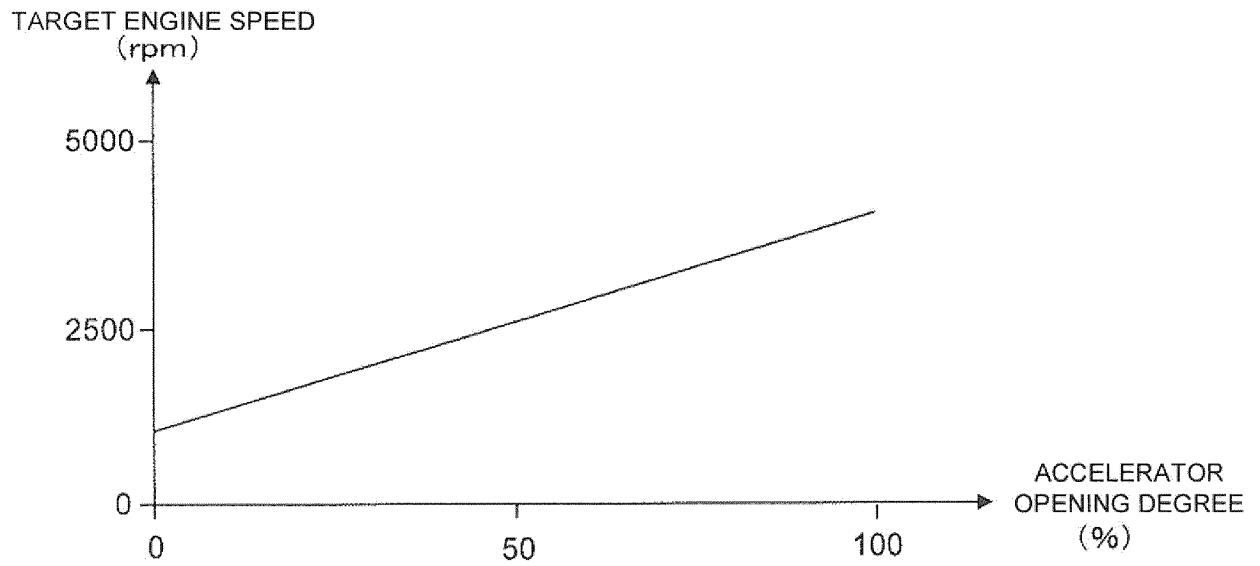


Fig. 4

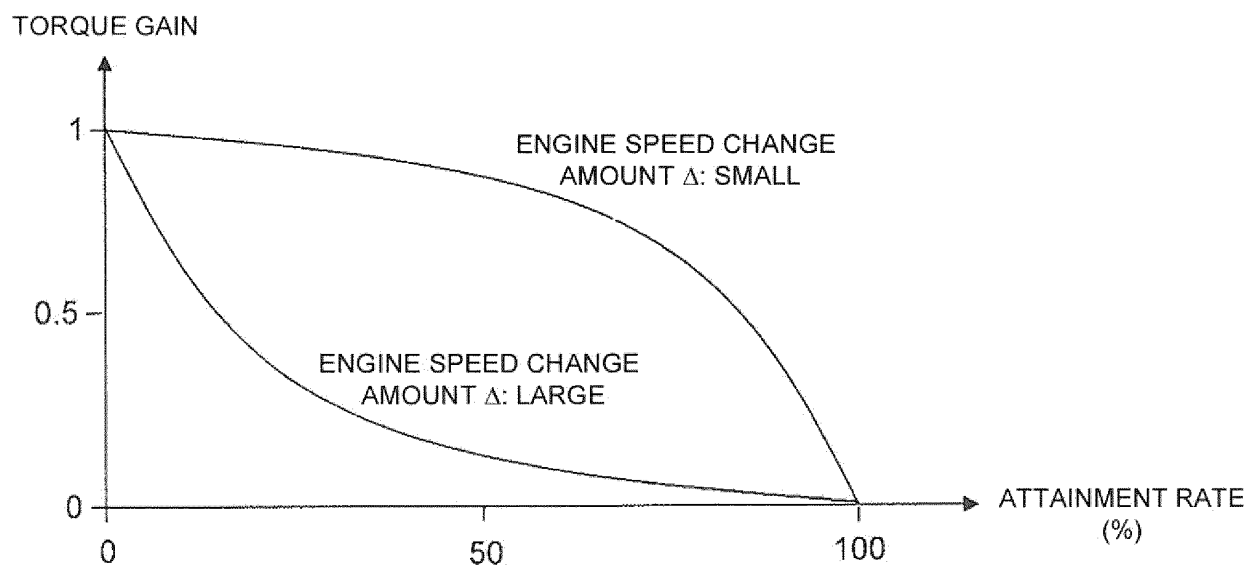


Fig. 5

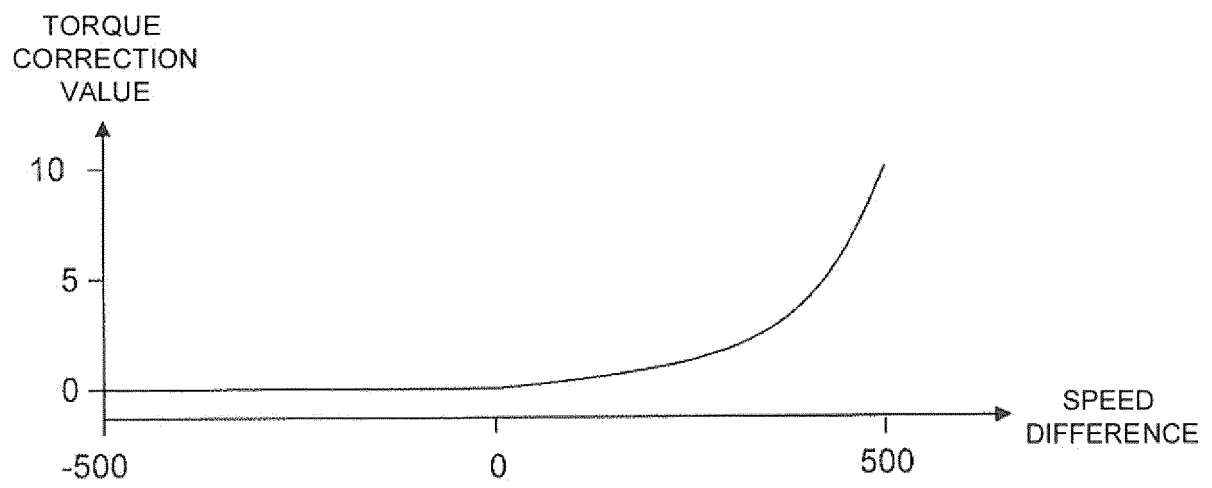


Fig. 6

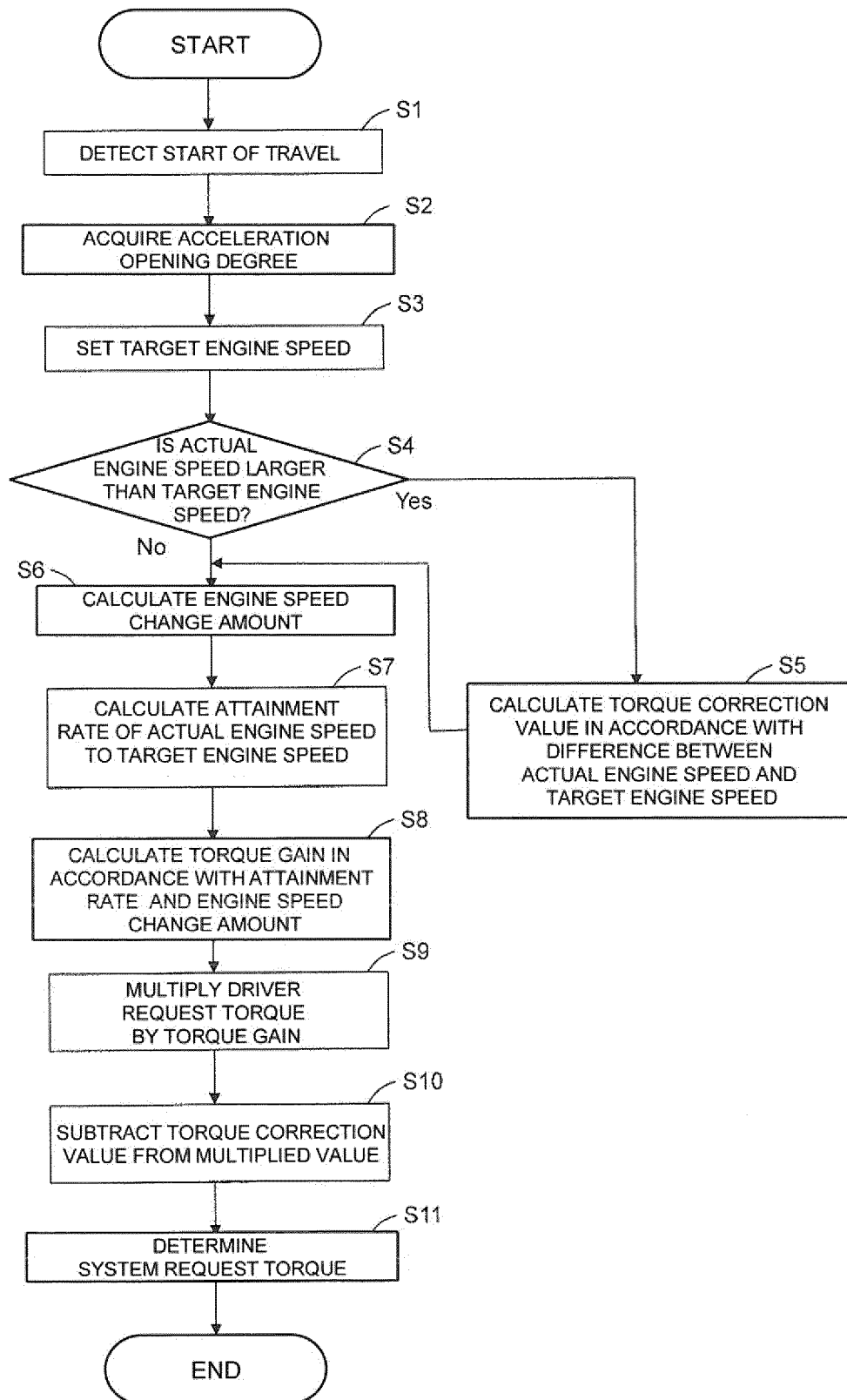


Fig. 7

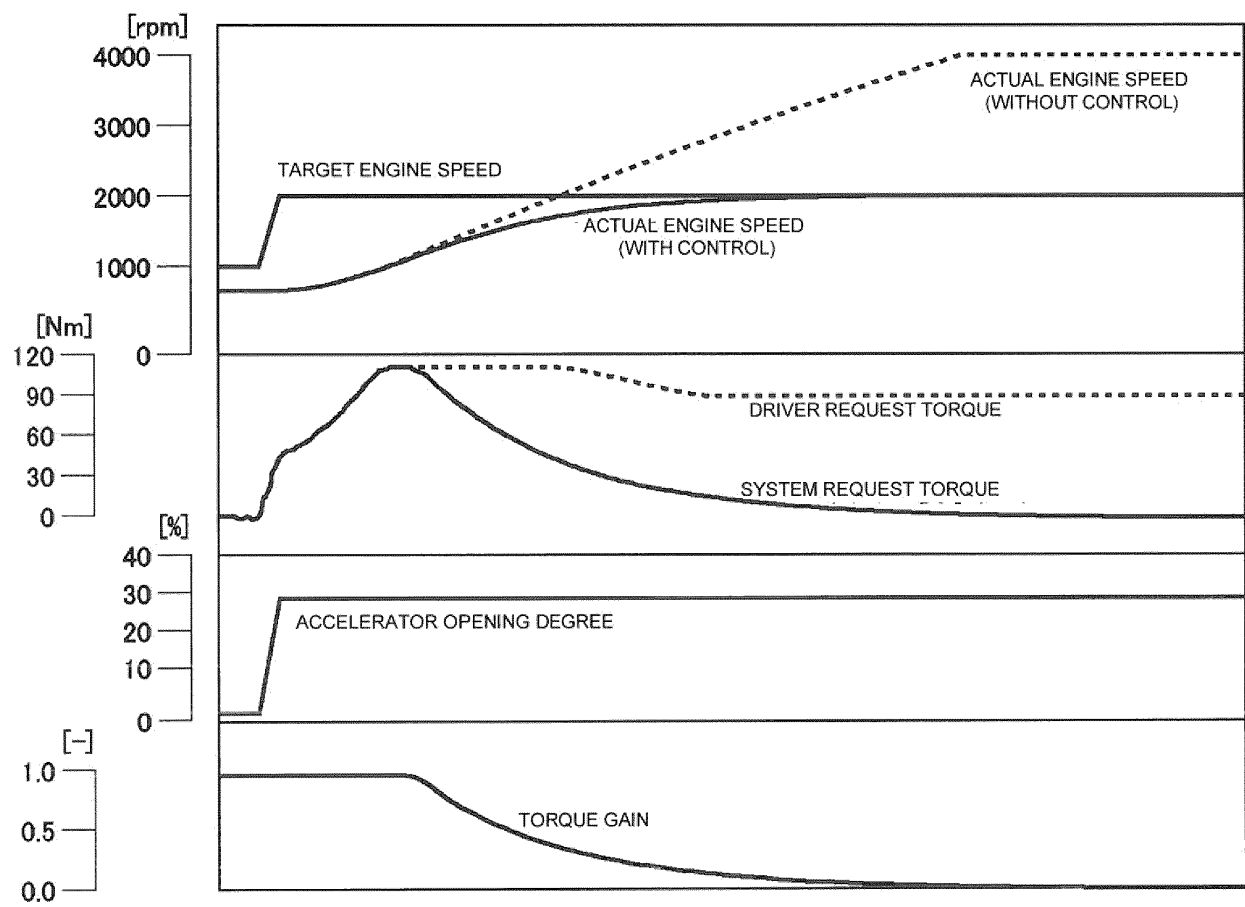
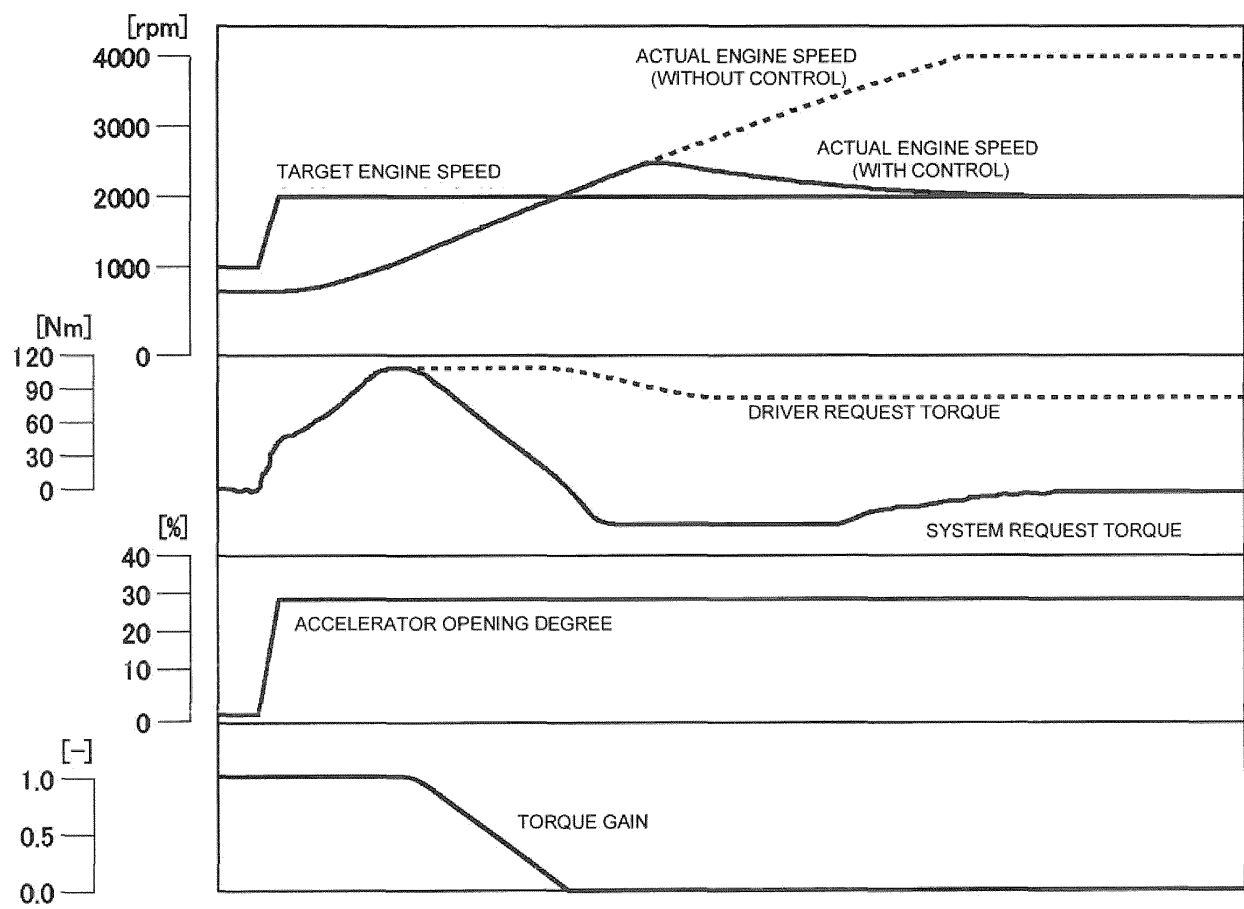


Fig. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/002637

A. CLASSIFICATION OF SUBJECT MATTER

F02D45/00(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F02D45/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015

Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 7-293319 A (Hitachi, Ltd.), 07 November 1995 (07.11.1995), paragraphs [0013], [0016] & US 6058348 A & US 6298300 B1 & US 2002/0013653 A1 & DE 19515508 C2 & DE 19515508 A1	1, 3 2, 4-7
Y A	JP 2009-174401 A (Toyota Motor Corp.), 06 August 2009 (06.08.2009), paragraphs [0006], [0016], [0022], [0034] to [0037]; fig. 2, 5 (Family: none)	1, 3 2, 4-7
Y A	JP 2012-30664 A (Mitsubishi Motors Corp.), 16 February 2012 (16.02.2012), paragraph [0030] & CN 102343908 A	1, 3 2, 4-7

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

11 June 2015 (11.06.15)

Date of mailing of the international search report

23 June 2015 (23.06.15)

Name and mailing address of the ISA/
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Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2011163233 A [0006]