[NAME OF THE DOCUMENT] Abstract

[ABSTRACT]

[TASK] To provide a vehicle running control apparatus that can enhance the degree of reflection of a driver's intention on running of a vehicle when the driver has operated an accelerator operator.

[MEANS OF SOLUTION] In determining whether or not quick operation of an accelerator pedal has been performed, a vehicle running control apparatus determines whether or not an operation speed of the accelerator pedal is equal to or higher than a quick operation determination threshold th1 that has been changed on the basis of a stroke amount of the accelerator pedal. Therefore, the vehicle running control apparatus changes the control contents of a power source on the basis of a determination that changes on the basis of a stroke amount of the accelerator pedal. Thus, the vehicle running control apparatus can more accurately cause running control of a vehicle to reflect a driver's intention.

[SELECTED DRAWING] FIG. 3

WE CLAIM:

1. A vehicle running control system (1) that, at the time of controlling driving force, determines whether an operating speed that is a speed at which a driver operates an accelerator operator (10) is higher than or equal to a threshold and that changes details of control over the driving force on the basis of a result of the determination, the vehicle running control system (1) characterized by comprising:

a threshold setting unit (123) that sets the threshold on the basis of operation information, other than the operating speed of the accelerator operator (10), within information related to operation of the accelerator operator (10) ; wherein

the operation information is a stroke amount that is an operation amount of the accelerator operator (10) when the driver has operated the accelerator operator (10) when the driver has operated the accelerator operator (10),

the threshold is set to be larger as the stroke amount increases, and

when it is determined that the operating speed is higher than or equal to the threshold, the details of control over the driving force are changed so that a rate of change of the driving force is increased as compared with a rate of change during normal times.

2. The vehicle running control system (1) according to claim 1, wherein

the vehicle running control system (1) calculates an absolute value of a difference between an operation amount at a start of operation of the accelerator operator (10) and an operation amount at an end of operation of the accelerator operator (10) as the stroke amount, and

the end of operation is time at which a predetermined period of time has elapsed after the operating speed becomes a maximum value.

3. The vehicle running control system (1) according to claim 1, wherein

the vehicle running control system (1) calculates an absolute value of a difference between an operation amount at a start of operation of the accelerator operator (10) and

an operation amount at an end of operation of the accelerator operator (10) as the stroke amount, and

the end of operation is time at which the operating speed has decreased by a predetermined speed after the operating speed becomes a maximum value.

4. The vehicle running control system (1) according to claim 1, wherein

the vehicle running control system (1) determines whether the driver has quickly released the accelerator operator(10), and

the operation information is an accelerator operation amount when the driver starts quickly releasing the accelerator operator (10).

5. The vehicle running control system (1) according to claim 1, wherein

the operation information is information as to whether the driver has operated the accelerator operator (10) from a fully closed state when the driver starts operating the accelerator operator (10), and wherein

said threshold setting unit (123) is configured to increase the threshold when the driver has operated the accelerator operator (10) from a fully closed state when the driver starts operating the accelerator operator (10).

6. The vehicle running control system (1) according to any one of claims 1 to 3 and 5, wherein

the vehicle running control system (1) determines whether the driver has quickly depressed the accelerator operator (10), and determines whether the driver has quickly released the accelerator operator (10),

when it is determined that the driver has quickly depressed the accelerator operator (10), the details of control over the driving force are changed so that a target output value is increased with respect to a target output value during normal times, which is set in correspondence with the detected accelerator operation amount, and

when it is determined that the driver has quickly released the accelerator operator

(10), the details of control over the driving force are changed so that the target output value is decreased with respect to the target output value during normal times.

7. The vehicle running control system (1) according to claim 1, wherein

when it is determined that the operating speed is higher than or equal to the threshold, an output value of the vehicle is increased, which is required by the driver.

8. The vehicle running control system (1) according to claim 7, wherein said output value of the vehicle is one of a target acceleration, a target torque and a target driving force.

9. A vehicle running control system (1) characterized by comprising:

a control unit (125) that, at the time of controlling driving force, changes details of control over the driving force on the basis of an operating speed that is a speed at which a driver operates an accelerator operator (10) and a stroke amount that is an operation amount of the accelerator operator (10) when the driver has operated the accelerator operator (10).

10. A vehicle running control method in which, at the time of controlling driving force, it is determined whether an operating speed that is a speed at which a driver operates an accelerator operator (10) is higher than or equal to a threshold and that changes details of control over the driving force on the basis of a result of the determination, the vehicle running control method characterized by comprising:

setting the threshold on the basis of operation information, other than the operating speed of the accelerator operator, within information related to operation of the accelerator operator (10) ; wherein

the operation information is a stroke amount that is an operation amount of the accelerator operator (10) wherein the driver has operated the accelerator operator (10),

said setting the threshold is performed by setting said threshold to be larger as the stroke amount increases, and the method further comprises

changing, when it is determined that the operating speed is higher than or equal to the threshold, the details of control over the driving force so that a rate of change of the driving force is increased as compared with a rate of change during normal times.

11. A vehicle running control method, characterized by comprising:

at the time of controlling driving force, changing details of control over the driving force on the basis of an operating speed that is a speed at which a driver operates an accelerator operator (10) and a stroke amount that is an operation amount of the accelerator operator (10) when the driver has operated the accelerator operator (10).

Dated this 17th day of July 2012

Of Anand and Anand, Advocates

Agents for the Applicants

[NAME OF THE DOCUMENT] Drawings

[FIG. 1]

11 ACCELERATOR OPENING DEGREE SENSOR

20 DRIVING FORCE GENERATION DEVICE

20a POWER SOURCE

20b TRANSMISSION

[FIG. 2]

120 ACCELERATOR OPENING DEGREE DETECTION UNIT

121 OPERATION SPEED DETECTION UNIT

122 OPERATION INFORMATION DETECTION UNIT

123 THRESHOLD SETTING UNIT

124 OPERATION DETERMINATION UNIT

125 CONTROL UNIT

(1) ACCELERATOR OPENING DEGREE

(2) OPERATION SPEED

(3) OPERATION INFORMATION

[FIG. 3]

(1) ACCELERATOR OPENING DEGREE

(2) DETERMINATION PERIOD T

(3) STROKE AMOUNT

(4) OPERATION SPEED

(5) SET THRESHOLD th1

(6) POINT WHERE OPERATION SPEED ASSUMES MAXIMUM VALUE

(7) QUICK DEPRESSION DETERMINATION FLAG

(8) TIME

[FIG. 4]

(1) OPERATION SPEED

(2) DETECTION START SPEED

(3), (8) TIME

(4) ACCELERATOR OPENING DEGREE

(5) FINAL OPENING DEGREE

(6) STROKE AMOUNT

(7) INITIAL OPENING DEGREE

[FIG. 5]

(1) OPERATION SPEED

(2) DETECTION START SPEED

(3), (8) TIME

(4) ACCELERATOR OPENING DEGREE

(5) FINAL OPENING DEGREE

(6) STROKE AMOUNT

(7) INITIAL OPENING DEGREE

[FIG. 6]

S100 DETECT OPERATION SPEED AND OPERATION INFORMATION

S101 DETERMINE THRESHOLD

S102 IS OPERATION SPEED EQUAL TO OR HIGHER THAN THRESHOLD?

S103 GENERATE DRIVING FORCE THROUGH QUICK CONTROL

S104 GENERATE DRIVING FORCE THROUGH NORMAL CONTROL

(1) START

(2) RETURN

[FIG. 7]

(1) ACCELERATOR OPENING DEGREE

(2) INITIAL OPENING DEGREE

(3) OPERATION SPEED

(4) SET THRESHOLD th1

(5) MAXIMUM VALUE OF OPERATION SPEED IN RETURNING DIRECTION (ABSOLUTE VALUE OF OPERATION SPEED)

(6) QUICK RELEASE DETERMINATION FLAG

(7) TIME

[FIG. 8]

(1) OPERATION SPEED

(2), (7) TIME

(3) DETECTION START SPEED

(4) ACCELERATOR OPENING DEGREE

(5) INITIAL OPENING DEGREE

(6) EQUIVALENT TO STROKE AMOUNT

[FIG. 9]

(1) ACCELERATOR OPENING DEGREE

(2) DETERMINATION PERIOD T

(3) INITIAL OPENING DEGREE IS EQUAL TO 0 (ACCELERATOR PEDAL IS FULLY CLOSED)

(4) OPERATION SPEED

(5) THRESHOLD IS INCREASED

(6) POST-CHANGE THRESHOLD th3

(7) POINT WHERE OPERATION SPEED ASSUMES MAXIMUM VALUE

(8) PRE-CHANGE THRESHOLD th2

(9) QUICK DEPRESSION DETERMINATION FLAG

(10) TIME

CERTIFICATION

I, Takuo Nakamura, of 602 Royal Mansion Konan, 62 Sugiyama, Kochino-cho, Konan, Aichi, 483-8211, Japan, hereby certify that I am the translator of the documents related to the patent application filed in Japan identified below, and certify that the accompanying translation is a true and correct translation of the documents to the best of my knowledge and belief.

Application Number	Date of Filing
Japanese Patent Application No. 2010-008535	January 18, 2010

Takuo Nakamura

Takuo Nakamura

Dated this 6th day of June, 2012

[NAME OF THE DOCUMENT] APPLICATION FOR PATENT

[SERIAL NUMBER] 2009-05637

[DATE OF SUBMISSION] January 18, 2010

[ADDRESSEE] Commissioner of Patent Office

[INT. CL.] B60W 10/04

[INVENTOR]

[DOMICILE OR RESIDENCE] c/o TOYOTA JIDOSHA KABUSHIKI KAISHA

1, Toyota-cho, Toyota-shi, Aichi-ken

[NAME] Koki MATSUSHITA

[APPLICANT]

[ID NUMBER] 000003207

[NAME] TOYOTA JIDOSHA KABUSHIKI KAISHA

[LEGAL REPRESENTATIVE]

[ID NUMBER] 100089118

[PATENT ATTORNEY]

[NAME] Hiroaki SAKAI

[DESIGNATED LEGAL REPRESENTATIVE]

[ID NUMBER] 100117075

[PATENT ATTORNEY]

[NAME] Kenta ITO

[APPLICATION FEE]

[PAYMENT NUMBER] 008268

[AMOUNT OF PAYMENT] 15,000 yen

[LIST OF ATTACHED DOCUMENTS]

[NAME OF THE DOCUMENT] Specification 1

[NAME OF THE DOCUMENT] Claims 1

[NAME OF THE DOCUMENT] Abstract 1

[NAME OF THE DOCUMENT] Drawings 1

[NUMBER OF THE GENERAL POWER OF ATTORNEY] 0817300

[NAME OF THE DOCUMENT] Specification

[TITLE OF THE INVENTION] VEHICLE RUNNING CONTROL APPARATUS

[TECHNICAL FIELD]

[0001]

The invention relates to a vehicle running control apparatus.

[BACKGROUND ART]

[0002]

Conventionally, a vehicle running control apparatus has been proposed as a control apparatus that controls running of a vehicle such as an automobile or the like. The vehicle running control apparatus makes running control of the vehicle different from running control during normal operation in the case where a driver has performed an operation of quickly depressing or quickly releasing an accelerator pedal.

[0003]

There is such a vehicle running control apparatus that changes the driving force of a vehicle by a driving force control device on the basis of, for example, an operation speed as a speed at which a driver operates an accelerator pedal. More specifically, when the driver has performed the operation of quickly depressing or quickly releasing the accelerator pedal, the vehicle running control apparatus detects a relatively high operation speed of the accelerator pedal, and controls a power source such as an engine or

the like on the basis of this detected operation speed of the accelerator pedal, thereby generating a driving force having a higher rate of change than a rate of change in the driving force generated during normal control. Thus, the vehicle running control apparatus can, for example, accelerate or decelerate the vehicle by a larger amount than in the case of a vehicle that is controlled though normal control, when the driver has performed the operation of quickly depressing or quickly releasing the accelerator pedal.

[0004]

As an art related to the above, there is proposed, for example, a vehicle driving force control apparatus that controls the driving force of a vehicle on the basis of a rate of change in an accelerator operation amount, that is, an operation speed of an accelerator pedal (Patent Document 1). The vehicle driving force control apparatus disclosed in Patent Document 1 detects a vehicle speed, an accelerator operation amount, and a rate of change in the accelerator operation amount to generate a vehicle speed control target driving force and an acceleration control target driving force, and furthermore, summates the vehicle speed control target driving force and the acceleration control target driving force to generate a target driving force of the vehicle that corresponds to a driver's request.

[Related Art Document]

[Patent Document]

[0005]

[Patent Document 1]

Japanese Patent Application Publication No. 2003-237421 (JP-2003-237421 A)

[DISCLOSURE OF THE INVENTION]

[Problem to Be Solved by the Invention]

[0006]

Incidentally, in general, when a driver operates an accelerator pedal, the operation speed of the accelerator pedal tends to vary in accordance with the magnitude of a stroke amount as an amount by which the driver operates the accelerator pedal. Therefore, for example, even in the case where the driver does not intend to perform an operation of quickly depressing the accelerator pedal, when the driver depresses the accelerator pedal and then the stroke amount of the accelerator pedal becomes relatively large, the operation speed of the accelerator pedal also becomes relatively high. Consequently, a large driving force tends to be generated with respect to a driving force generated through normal control. That is, the driver's intention may not be reflected on running of a vehicle. There is room for an improvement in causing running of the vehicle to reflect the driver's intention in the case where the driver has operated the accelerator pedal.

[0007]

The invention has been made in view of the foregoing. It is an object of the invention to obtain a vehicle running control apparatus that can enhance the degree of reflection of a driver's intention on running of a vehicle when the driver has operated an accelerator operator.

[Means for Solving the Problem]

[0008]

In order to solve the aforementioned problem and achieve the object, a vehicle running control apparatus according to the invention determines whether or not an operation speed as a speed at which a driver operates an accelerator operator is equal to or higher than a threshold in controlling a driving force, and changes contents of control of the driving force in accordance with a result of the determination. This vehicle running control apparatus is characterized by changing the threshold on the basis of a piece of operation information other than the operation speed of the accelerator operator among pieces of information on operation of the accelerator operator.

[0009]

Further, in the aforementioned vehicle running control apparatus, it is preferable that the piece of the operation information be a stroke amount as an operation amount of the accelerator operator at a time when the driver operates the accelerator operator, or an accelerator opening degree at a time when the driver starts operating the accelerator

operator.

[0010]

Further, in the aforementioned vehicle running control apparatus, it is preferable that the piece of the operation information be a piece of information indicating whether or not the accelerator operator has been operated from a fully closed state when the driver starts operating the accelerator operator.

[0011]

Further, a vehicle running control apparatus according to the invention is characterized by changing contents of control of a driving force on the basis of an operation speed as a speed at which a driver operates an accelerator operator and a stroke amount as an operation amount of the accelerator operator at a time when the driver operates the accelerator operator, in controlling the driving force.

[Effects of the Invention]

[0012]

According to the invention, when it is determined whether or not the operation speed of the accelerator operator is equal to or higher than the threshold, the threshold is changed on the basis of the piece of the operation information on the accelerator operator. That is, according to the invention, when it is determined whether or not quick operation of the accelerator operator has been performed, it is determined whether or not the

operation speed of the accelerator operator is equal to or higher than the quick operation determination threshold that is changed on the basis of the piece of the operation information on the accelerator operator. Thus, the invention exerts an effect of making it possible to enhance the accuracy in determining whether or not the driver has quickly operated the accelerator operator in comparison with, for example, a vehicle running control apparatus that is configured to determine whether or not the driver has quickly operated the accelerator operator on the basis of only the operation speed of the accelerator operator. It should be noted herein that the quick operation means, for example, that the driver operates the accelerator operator more quickly than during normal operation on the basis of the driver's intention at the time of rapid acceleration, at the time of rapid deceleration, in case of emergency, or the like. Further, according to the invention, when it is determined whether or not quick operation has been performed, it is determined whether or not the operation speed of the accelerator operator is equal to or higher than the quick operation determination threshold that is changed on the basis of the piece of the operation information on the accelerator operator. Therefore, the invention changes the contains of control of the driving force on the basis of a determination that changes on the basis of the piece of the operation information on the accelerator operator. Thus, the invention makes it possible to cause running control of the vehicle to more accurately reflect the driver's intention than, for example, a vehicle

running control apparatus that is configured to change the contents of control of the driving force on the basis of only the operation speed of the accelerator operator. That is, the invention exerts an effect of making it possible to enhance the degree of reflection of the driver's intention on running of the vehicle in the case where the driver has operated the accelerator operator.

[0013]

Further, according to the invention, the driving force is controlled on the basis of the operation speed of the accelerator operator and the stroke amount of the accelerator operator. Thus, the invention makes it possible to more accurately cause running control of the vehicle to reflect a driver's intention than, for example, a vehicle running control apparatus that is configured to change the contents of control of the driving force on the basis of only the operation speed of the accelerator operator. That is, the invention can exert the effect of enhancing the degree of reflection of the driver's intention on the running of the vehicle when the driver has operated the accelerator operator.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0014]

[FIG. 1] FIG. 1 is a block diagram showing an overall configuration of a vehicle running control apparatus according to a first embodiment of the invention.

[FIG. 2] FIG. 2 is a functional block diagram schematically showing a configuration of functions of an ECU.

[FIG. 3] FIG. 3 includes timing charts showing changes over time in an accelerator opening degree, an accelerator pedal operation speed, and a quick depression determination flag respectively.

[FIG. 4] FIG. 4 includes graphs showing changes over time in the operation speed and the accelerator opening degree respectively in the case where a driver depresses the accelerator pedal.

[FIG. 5] FIG. 5 includes graphs showing changes over time in the operation speed and the accelerator opening degree respectively in the case where the driver depresses the accelerator pedal.

[FIG. 6] FIG. 6 is a view showing a flowchart of an operation procedure of the vehicle running control apparatus.

[FIG. 7] FIG. 7 includes timing charts showing changes over time in the accelerator opening degree, the accelerator pedal operation speed, and the quick release determination flag respectively in a vehicle running control apparatus according to a second embodiment of the invention.

[FIG. 8] FIG. 8 includes graphs showing changes over time in the operation speed and the accelerator opening degree respectively in the case where the driver

releases his/her foot from the accelerator pedal.

[FIG. 9] FIG. 9 includes timing charts showing changes over time in the accelerator opening degree, the accelerator pedal operation speed, and the quick depression determination flag respectively in a vehicle running control apparatus according to a third embodiment of the invention.

[MODES FOR CARRYING OUT THE INVENTION]

[0015]

Hereinafter, embodiments of a vehicle running control apparatus according to the invention will be descried in detail on the basis of the drawings. It should be noted that this invention is not limited by the following respective embodiments thereof.

[0016]

[First Embodiment] Hereinafter, a vehicle running control apparatus according to the first embodiment of the invention will be described. FIG. 1 is a block diagram showing an overall configuration of a vehicle running control apparatus according to the first embodiment of the invention.

[0017]

A vehicle running control apparatus 1 controls a driving force generation device 20 to thereby control running of a vehicle. This driving force generation device 20 is composed of a power source 20a and a transmission 20b. The driving force generation

device 20 increases/reduces the power generated by the power source 20a or changes the speed of the transmission 20b to increase/reduce the power transmitted from the transmission 20b, thereby making it possible to increase/reduce a driving force. That is, the vehicle running control apparatus 1 according to the first embodiment of the invention controls the driving force generation device 20 to appropriately increase/reduce the driving force, thereby controlling running of the vehicle. The vehicle running control apparatus 1 is equipped with an accelerator pedal 10, an accelerator opening degree sensor 11, and an ECU 12.

[0018]

It should be noted herein that the power source 20a generates a power for causing the vehicle such as an automobile or the like to run, and an engine is used as the power source 20a. It should be noted that the power source 20a may be, for example, an electric motor or a so-called hybrid power source that is obtained by combining an engine with an electric motor. The power source 20a is directly or indirectly coupled to driving wheels 21 of the vehicle via the transmission 20b, which is connected to the power source 20a. When the power source 20a is connected to the driving wheels 21 by the transmission 20b, it can transmit a generated power to the driving wheels 21 as a driving force via the transmission 20b, thereby making it possible to cause the vehicle to run.

[0019]

The accelerator pedal 10 is an accelerator operator. The accelerator pedal 10 serves input means used in increasing/reducing a power generated by the power source 20a or increasing/reducing a power transmitted from the transmission 20b by changing the speed of the transmission 20b.

[0020]

The accelerator opening degree sensor 11 is provided as accelerator opening degree detection means for detecting an accelerator opening degree. This accelerator opening degree sensor 11 can output an accelerator opening degree signal as a signal corresponding to a position of the accelerator pedal 10 in a moving direction of the accelerator pedal 10, namely, an operation direction of the accelerator pedal 10 indicated by an arrow x in FIG. 1.

[0021]

The ECU 12 is composed of a processing unit (not shown), a storage unit (not shown), and an input/output unit (not shown). The processing unit performs calculation processing. The storage unit stores numeric values and the like. Signals are input/output to/from the input/output unit. The ECU 12 can control the driving force generation device 20 in accordance with an operation procedure that will be described later.

[0022]

FIG. 2 is a functional block diagram schematically showing a configuration of functions of the ECU 12. As shown in FIG. 2, the ECU 12 is equipped with an accelerator opening degree detection unit 120, an operation speed detection unit 121, an operation information detection unit 122, a threshold setting unit 123, an operation determination unit 124, and a control unit 125. These components are installed in the aforementioned processing unit.

[0023]

The accelerator opening degree detection unit 120 is equivalent to accelerator opening degree detection means, and detects an accelerator opening degree on the basis of an accelerator opening degree signal output from the accelerator opening degree sensor 11.

[0024]

The operation speed detection unit 121 is equivalent to operation speed detection means, and detects an operation speed of the accelerator pedal 10 on the basis of the accelerator opening degree detected by the accelerator opening degree detection unit 120.

[0025]

The operation information detection unit 122 is equivalent to operation information detection means, and detects a piece of operation information on the accelerator pedal 10 on the basis of the accelerator opening degree detected by the

accelerator opening degree detection unit 120. It should be noted that the piece of the operation information on the accelerator pedal 10 mentioned herein is a piece of information other than the operation speed of the accelerator pedal 10 among pieces of information on the driver's operation of the accelerator pedal 10. This piece of the operation information is, for example, a stroke amount as an operation amount of the accelerator pedal 10 at the time when the driver operates the accelerator pedal 10, an accelerator opening degree at the time when the driver starts operating the accelerator pedal 10, a piece of information indicating whether or not the driver has depressed the fully closed accelerator pedal 10 when the driver starts operating the accelerator pedal 10, or the like. Hereinafter, in the vehicle running control apparatus 1 according to the first embodiment of the invention, an example in which the operation information on the accelerator pedal 10 is a stroke amount will be described.

[0026]

The threshold setting unit 123 is equivalent to threshold setting means, and sets a threshold of the operation speed of the accelerator pedal 10 on the basis of the stroke amount as the piece of the operation information on the accelerator pedal 10, which is detected by the operation information detection unit 122, thereby changing the threshold of the operation speed of this accelerator pedal 10. The threshold of the operation speed of the accelerator pedal 10 mentioned herein is a quick operation determination threshold

for determining whether or not the driver has quickly operated the accelerator pedal 10.

[0027]

The operation determination unit 124 is equivalent to determination means, and determines whether or not the operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, is equal to or higher than the threshold set by the threshold setting unit 123.

[0028]

The control unit 125 is equivalent to driving force control means, and controls the power source 20a in accordance with a result of the determination made by the operation determination unit 124. In controlling the power source 20a, this control unit 125 causes the power source 20a to generate a power that corresponds in magnitude to the accelerator opening degree detected by the accelerator opening degree detection unit 120.

[0029]

Next, the operation of the vehicle running control apparatus 1 according to the first embodiment of the invention will be described.

[0030]

When the driver performs an operation of depressing or returning the accelerator pedal 10, an accelerator opening degree signal corresponding to this operation is output

from the accelerator opening degree sensor 11. In this case, the accelerator opening degree detection unit 120 detects an accelerator opening degree on the basis of the accelerator opening degree signal output from the accelerator opening degree sensor 11. Then, the control unit 125 controls the power source 20a on the basis of a result of the detection carried out by the accelerator opening degree detection unit 120. Thus, the control unit 125 controls the power generated by the power source 20a to thereby control the driving force.

[0031]

Further, the vehicle running control apparatus 1 changes the contents of control performed by the control unit 125 for the power source 20a in accordance with a result of the determination made by the operation determination unit 124. In the vehicle running control apparatus 1 according to the first embodiment of the invention, the operation determination unit 124 determines whether or not the driver has quickly operated the accelerator pedal 10, on the basis of the operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, and the stroke amount of the accelerator pedal 10, which is detected by the operation information detection unit 122. This operation determination unit 124 determines whether or not the operation speed of the accelerator pedal 10 is equal to or higher than a threshold, and the control unit 125 changes the contents of control performed for the power source 20a on the basis of a

result of the determination made by this operation determination unit 124.

[0032]

FIG. 3 includes timing charts showing changes over time in the accelerator opening degree, the operation speed of the accelerator pedal 10, and a quick depression determination flag. It should be noted that a symbol α shown in (a) of FIG. 3 indicates an accelerator opening degree prior to the depression of the accelerator pedal 10 by the driver. As indicted by (a) and (b) in FIG. 3, for example, when the driver depresses the accelerator pedal 10 and then the accelerator opening degree increases (at a time t1), the operation information detection unit 122 obtains a stroke amount of the accelerator pedal 10 in a determination period T on the basis of the accelerator opening degree detected by the accelerator opening degree detection unit 120. The determination period T is a period for determining whether or not the driver has quickly operated the accelerator pedal 10, and is a period from a time when the operation speed of the accelerator pedal 10 exceeds a later-described detection start speed to a time when the operation speed changes by a later-described speed variation Δv with respect to a later-described peak operation speed of the accelerator pedal 10. It should be noted that a symbol t2 shown in FIG. 3 indicates a time when the determination period T ends.

[0033]

More specifically, in the vehicle running control apparatus 1 according to the

first embodiment of the invention, the operation information detection unit 122 obtains a stroke amount of the accelerator pedal 10 as follows. FIG. 4 includes graphs showing changes over time in the operation speed and the accelerator opening degree in the case where the driver depresses the accelerator pedal 10. As indicated by (a) and (b) in FIG. 4, when the driver depresses the accelerator pedal 10, the accelerator opening degree detection unit 120 detects an initial opening degree. The initial opening degree is an accelerator opening degree at an instant when the operation speed of the accelerator pedal 10 exceeds a detection start speed preset in the operation speed detection unit 121. It should be noted herein that the detection start speed is a threshold for allowing the operation speed detection unit 121 to start measuring an operation speed of the accelerator pedal 10 to ensure that the operation information detection unit 122 detects a stroke amount of the accelerator pedal 10, and is stored in advance in the storage unit of the ECU 12.

[0034]

Besides, the operation speed detection unit 121 detects a peak operation speed as a peak value of a subsequent operation speed of the accelerator pedal 10. In addition, the accelerator opening degree detection unit 120 detects a final opening degree as an accelerator opening degree at which a variation with respect to the initial opening degree is the largest, from a time when the operation speed of the accelerator pedal 10 reaches

the peak operation speed to a time when the operation speed of the accelerator pedal 10 changes by a speed variation Δv with respect to this peak operation speed. That is, the final opening degree in the case where the driver depresses the accelerator pedal 10 is an accelerator opening degree at the time t2, and is a maximum accelerator opening degree in the determination period T. In this case, the operation speed detection unit 121 detects a maximum value of the operation speed in a direction in which the accelerator pedal 10 is depressed as a peak operation speed, and the accelerator opening degree detection unit 120 detects an accelerator opening degree at the end of the determination period T (at the time t2), which reaches its maximum from a time when the operation speed of the accelerator pedal 10 reaches the peak operation speed to a time when the operation speed of the accelerator pedal 10 decreases by the speed variation Δv with respect to this peak operating speed, as the final opening degree. Then, the operation information detection unit 122 calculates a difference between the initial opening degree detected by the accelerator opening degree detection unit 120 and the final opening degree detected by the accelerator opening degree detection unit 120, and sets the absolute value of the difference as a stroke amount.

[0035]

It should be noted that the peak operation speed is obtained, for example, by causing the operation speed detection unit 121 to calculate a differential value of the

operation speed of the accelerator pedal 10 and then to detect an operation speed of the accelerator pedal 10 at the time when the sign of this differential value changes. That is, the peak operation seed is obtained, for example, by causing the operation speed detection unit 121 to detect an operation speed of the accelerator pedal 10 at the time when the sign of the differential value of the operation speed of the accelerator pedal 10 changes from positive to negative or from negative to positive. Further, the speed variation Δv is designed to end the measurement of the operation speed of the accelerator pedal 10, and is stored in advance in the storage unit of the ECU 12.

[0036]

It should be noted herein that the significance of setting the speed variation Δv will be described. Even in the case where the operation speed of the accelerator pedal 10 reaches the peak operation speed and then starts decreasing, for a certain period after that as well, the accelerator pedal 10 moves in the same direction as it moves at the time when the operation speed thereof reaches the peak operation speed. That is, the stroke amount of the accelerator pedal 10 continues to increase for a certain period even after the operation speed thereof has reached the peak operation speed. Thus, the operation information detection unit 122 dose not obtain a difference between the initial opening degree and the accelerator opening degree at the time when the operation speed of the accelerator pedal 10 has reached the peak operation speed, but obtains a difference

between the initial opening degree and the above-mentioned final opening degree, and then obtains a stroke amount of the accelerator pedal 10 on the basis of the difference thus obtained. That is, the operation information detection unit 122 sets the speed variation Δv to more appropriately detect a stroke amount of the accelerator pedal 10 that reflects the driver's intention.

[0037]

On the other hand, when the driver returns the accelerator pedal 10, the accelerator opening degree detection unit 120 detects an initial opening degree. Then, the operation speed detection unit 121 detects a maximum value of the operation speed in a direction in which the accelerator pedal 10 is returned as a peak operation speed, and then the accelerator opening degree detection unit 120 detects an accelerator opening degree, which is at its minimum from a time when the operation speed of the accelerator pedal 10 reaches the peak operation speed to a time when the operation speed of the accelerator pedal 10 decreases by the speed variation Δv with respect to this peak operation speed, as a final opening degree. Then, the operation information detection unit 122 calculates a difference between the initial opening degree detected by the accelerator opening degree detection unit 120 and the final opening degree detected by the accelerator opening degree detection unit 120, and sets the absolute value of the difference as a stroke amount of the accelerator pedal 10.

[0038]

As described above, the operation information detection unit 122 detects a stroke amount of the accelerator pedal 10.

[0039]

It should be noted that the stroke amount of the accelerator pedal 10 may be detected by the operation information detection unit 122 according to a method other than the above-mentioned method. FIG. 5 includes graphs showing changes over time in the operation speed and the accelerator opening degree in the case where the driver depresses the accelerator pedal 10. For example, as indicated by (a) and (b) in FIG. 5, when the driver depresses the accelerator pedal 10, the accelerator opening degree detection unit 120 detects an initial opening degree and then detects a final opening degree. The final opening degree mentioned herein is an accelerator opening degree at which the variation with respect to the initial opening degree is the largest until the time variation Δt elapses from a time when the operation speed of the accelerator pedal 10 exceeds the detection start speed. That is, even when the final opening degree is thus obtained, the final opening degree in the case where the driver depresses the accelerator pedal 10 is an accelerator opening degree at the time t2, and is a maximum accelerator opening degree in the determination period T. The determination period T in this case is a period to the lapse of the time variation Δt from a time when the operation speed of the accelerator

pedal 10 exceeds the detection start speed. It should be noted herein that the accelerator opening degree detection unit 120 detects a maximum accelerator opening degree at the end of the determination period T (at the time t2) to the lapse of the time variation Δt from a time when the operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, exceeds the detection start speed, as a final opening degree. Further, the time variation Δt is designed to end the measurement of the operation speed of the accelerator pedal 10, and is stored in advance in the storage unit of the ECU 12. Then, the operation information detection unit 122 calculates a difference between the initial opening degree detected by the accelerator opening degree detection unit 120 and the final opening degree detected by the accelerator opening degree detection unit 120, and sets the absolute value of the difference as a stroke amount of the accelerator pedal 10. Further, in the case where the driver returns the accelerator pedal 10 as well, the accelerator opening degree detection unit 120 detects the initial opening degree and the final opening degree. In this case, the accelerator opening degree detection unit 120 detects an accelerator opening degree, which is at its minimum to the lapse of the time variation Δt from a time when the operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, exceeds the detection start speed, as a final opening degree. Then, the operation information detection unit 122 calculates a difference between the initial opening degree detected by

the accelerator opening degree detection unit 120 and the final opening degree detected by the accelerator opening degree detection unit 120, and sets the absolute value of the difference as a stroke amount of the accelerator pedal 10.

[0040]

When the operation information detection unit 122 detects a stroke amount of the accelerator pedal 10, the threshold setting unit 123 sets a threshold th1 on the basis of the stroke amount of the accelerator pedal 10, which is detected by the operation information detection unit 122.

[0041]

More specifically, when the threshold setting unit 123 detects a stroke amount as a piece of operation information on the accelerator pedal 10, the threshold setting unit 123 refers to a threshold setting map stored in the storage unit, and then sets a threshold for determining whether or not the driver has quickly operated the accelerator pedal 10. It should be noted herein that the threshold setting map is a map in which the stroke amount of the accelerator pedal 10 as a piece of operation information on the accelerator pedal 10 is associated with the threshold set by the threshold setting unit 123. For example, a look-up table (an LUT) is used as the threshold setting map.

[0042]

Incidentally, the operation speed of the accelerator pedal 10 tends to increase as

the stroke amount of the accelerator pedal 10 increases. Therefore, in the threshold setting map, the quick operation determination threshold th1 is so set as to increase as the stroke amount of the accelerator pedal 10 increases. Accordingly, the threshold setting unit 123 that sets a threshold using this threshold setting map increases the set threshold th1 as the stroke amount of the accelerator pedal 10, which is detected by the operation information detection unit 122, increases.

[0043]

It should be noted that in setting the threshold th1 on the basis of the stroke amount of the accelerator pedal 10, the threshold setting unit 123 may employ, for example, a method in which a threshold setting function as a function of obtaining the threshold th1 set by the threshold setting unit 123 on the basis of the stroke amount of the accelerator pedal 10 is used, or a method in which the threshold th1 set through calculation made by the threshold setting unit 123 is used each time the stroke amount of the accelerator pedal 10 is detected, instead of the above-mentioned method in which the threshold setting map is referred to.

[0044]

When the threshold setting unit 123 sets the threshold th1, the operation determination unit 124 determines whether or not the peak operation speed, which is a maximum value of the operation speed of the acceleration pedal 10 in a period during

which the stroke amount of the accelerator pedal 10 is detected by the operation information detection unit 122, is equal to or higher than the threshold th1, and thereby determines whether or not the driver has performed an operation of quickly depressing the accelerator pedal 10. For example, as indicated by (b) in FIG. 3, since the peak operation speed is equal to or higher than the threshold th1, the operation determination unit 124 determines that the driver has performed the operation of quickly depressing the accelerator pedal 10 in such a case.

[0045]

When the operation determination unit 124 determines that the driver has performed the operation of quickly depressing the accelerator pedal 10, the operation determination unit 124 sets the value of a quick depression determination flag to 1, as indicated by (c) in FIG. 3. The quick depression determination flag is an operation determination flag at the time of the quick depression operation. That is, when the operation speed of the accelerator pedal 10 is equal to or higher than the threshold th1, the operation determination unit 124 determines that the driver has performed the operation of quickly depressing the accelerator pedal 10, and sets the quick depression determination flag to 1. Thus, the control unit 125 operates the power source 20a through quick control on the basis of this set value of the quick depression determination flag, namely, 1. That is, the control unit 125 makes a rate of change in the power

generated by the power source 20a higher than a normal rate of change as a rate of change in the power generated normally by the power source 20a on the basis of the value 1 of the quick depression determination flag, which is set by the operation determination unit 124.

[0046]

Further, the vehicle running control apparatus 1 sets the value of the operation determination flag during operation of the accelerator pedal 10 to 0 when the operation determination unit 124 determines whether or not the driver has quickly operated the accelerator pedal 10 on the basis of the operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, and the stroke amount of the accelerator pedal 10, which is detected by the operation information detection unit 122, and then determines that the driver has not quickly operated the accelerator pedal 10. The control unit 125 operates the power source 20a through normal control on the basis of the value of the operation determination flag, which is set by the operation determination unit 124, namely, 0.

[0047]

As described above, the control unit 125 makes a changeover between the operation of the power source 20a through normal control and the operation of the power source 20a through quick control, on the basis of the value of the operation determination

flag, which is set by the operation determination unit 124.

[0048]

Next, an operation procedure in the case where the power source 20a is controlled by the vehicle running control apparatus 1 according to the first embodiment of the invention will be described.

[0049]

FIG. 6 is a view showing a flowchart of the operation procedure of the vehicle running control apparatus 1.

[0050]

Each time the accelerator opening degree is changed, the ECU 12 calls up a determination routine for determining whether or not the driver has quickly operated the accelerator pedal 10 (START), and then performs a driving force control process as a process of controlling the driving force.

[0051]

In this determination routine, first of all, the operation speed detection unit 121 detects an operation speed of the accelerator pedal 10, and the operation information detection unit 122 detects a piece of operation information on the accelerator pedal 10 (step S100). In this step, the operation speed detection unit 121 obtains an operation speed of the accelerator pedal 10 such as a peak operation speed or the like, by

calculating a change over time in the accelerator opening degree on the basis of a resultant output from the accelerator opening degree detection unit 120. Further, the operation information detection unit 122 obtains a stroke amount as a piece of operation information on the accelerator pedal 10 on the basis of the resultant output from the accelerator opening degree detection unit 120.

[0052]

Subsequently, the threshold setting unit 123 sets the quick operation determination threshold th1 on the basis of the stroke amount of the accelerator pedal 10, which is obtained by the operation information detection unit 122 (step S101).

[0053]

Subsequently, the operation determination unit 124 determines whether or not the operation speed of the accelerator pedal 10, which is obtained by the operation speed detection unit 121, is equal to or higher than the threshold th1 set by the threshold setting unit 123 (step S102). In this step, the operation determination unit 124 determines whether or not the peak operation speed detected by the operation speed detection unit 121 is equal to or higher than the threshold th1 set by the threshold setting unit 123. That is, the operation determination unit 124 compares the peak operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, with the threshold th1 set by the threshold setting unit 123 on the basis of the stroke amount of the

accelerator pedal 10, which is detected by the operation information detection unit 122, to thereby determine whether or not the operation of quickly depressing or quickly releasing the accelerator pedal 10 has been performed.

[0054]

When it is determined that the operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, is equal to or higher than the threshold th1 set by the threshold setting unit 123 through the determination made by the operation determination unit 124 (YES in step S102), the control unit 125 generates a driving force through quick control (step S103). That is, when the operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, is equal to or higher than the threshold th1 set by the threshold setting unit 123, the operation determination unit 124 determines that the driver has performed the operation of quickly depressing or quickly releasing the accelerator pedal 10, and then sets the operation determination flag to 1. Then, the control unit 125 makes, for example, a rate of change in the power generated by the power source 20a higher than a normal rate of change as a rate of change in the power generated by the power source 20a during normal operation, on the basis of the value of this operation determination flag, namely, 1. Thus, for example, when the operation determination unit 124 determines that the driver has performed the operation of quickly depressing the accelerator pedal 10, the control unit

125 increases a target output value set in accordance with a value of the accelerator opening degree detected by the accelerator opening degree detection unit 120 with respect to a target output value during normal operation, which is set in accordance with the detected value of this accelerator opening degree. It should be noted that the target output value mentioned herein is an output value of the vehicle that is required by the driver, and is, for example, a target acceleration, a target torque, a target driving force, or the like. Further, for example, when the operation determination unit 124 determines that the driver has performed the operation of quickly releasing the accelerator pedal 10, the control unit 125 reduces the target output value with respect to the target output value used in normal control, to thereby, for example, increase a target deceleration. In the manner described above, when the control unit 125 generates a driving force through quick control, the control unit 125 maintains the control based on quick control until the driver operates the accelerator pedal 10 again to change the accelerator opening degree (RETURN).

[0055]

Further, when the operation determination unit 124 determines that the operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, is lower than the threshold th1 set by the threshold setting unit 123 (NO in step S102), the control unit 125 generates a driving force through normal control (step S104).

That is, because the peak operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, is lower than the quick operation determination threshold th1 set by the threshold setting unit 123 in accordance with the stroke amount of the accelerator pedal 10, which is set by the operation information detection unit 122, the operation determination unit 124 determines that the driver has performed neither the operation of quickly depressing the accelerator pedal 10 nor the operation of quickly releasing the accelerator pedal 10, and then sets the value of the operation determination flag to 0. Then, the control unit 125 sets the rate of change in the power generated by the power source 20a to the normal rate of change on the basis of the value of this operation determination flag, namely, 0. Thus, when the operation determination unit 124 determines that the driver has performed neither the operation of quickly depressing the accelerator pedal 10 nor the operation of quickly releasing the accelerator pedal 10, the control unit 125 sets the target output value set in accordance with the value of the accelerator opening degree detected by the accelerator opening degree detection unit 120 to the target output value during normal operation, which is set in accordance with the detected value of this accelerator opening degree.

[0056]

As described above, in the vehicle running control apparatus 1 according to the first embodiment of the invention, when the operation determination unit 124 determines

whether or not the operation speed of the accelerator pedal 10 is equal to or higher than the quick operation determination threshold th1, the threshold setting unit 123 changes the quick operation determination threshold th1 on the basis of the stroke amount as a piece of operation information on the accelerator pedal 10. That is, in determining whether or not the accelerator pedal 10 has been quickly operated, the operation determination unit 124 determines whether or not the operation speed of the accelerator pedal 10 is equal to or higher than the quick operation determination threshold th1 changed on the basis of the stroke amount as the piece of the operation information. Thus, the vehicle running control apparatus 1 can enhance the accuracy in determining whether or not the driver has quickly operated the accelerator pedal 10, in comparison with, for example, a vehicle running control apparatus that is configured to determine whether or not the driver has quickly operated the accelerator pedal on the basis of only the operation speed of the accelerator pedal 10.

[0057]

Further, when the vehicle running control apparatus 1 according to the first embodiment of the invention determines whether or not the accelerator pedal 10 has been quickly operated, the operation determination unit 124 determines whether or not the operation speed of the accelerator pedal 10 is equal to or higher than the quick operation determination threshold th1 that is changed on the basis of the stroke amount as the piece

of the operation information on the accelerator pedal 10. Therefore, the control unit 125 changes the contents of the control for the power source 20a of the driving force generation device 20 on the basis of a determination made by the operation determination unit 124, which changes on the basis of the stroke amount of the accelerator pedal 10. That is, the control unit 125 changes the contents of the control of the driving force on the basis of a determination made by the operation determination unit 124, which changes on the basis of the stroke amount of the accelerator pedal 10. Thus, the vehicle running control apparatus 1 according to the first embodiment of the invention can more accurately cause running control of the vehicle to reflect the driver's intention than, for example, a vehicle running control apparatus that is configured to change the contents of the control of the driving force on the basis of only the operation speed of the accelerator pedal. That is, the vehicle running control apparatus 1 according to the first embodiment of the invention can enhance the degree of reflection of the driver's intention on running of the vehicle in the case where the driver has operated the accelerator pedal 10.

[0058]

Further, in the vehicle running control apparatus 1 according to the first embodiment of the invention, as described above, the control unit 125 changes the contents of the control for the power source 20a on the basis of a determination made by

the operation determination unit 124, which changes on the basis of the stroke amount of the accelerator pedal 10. Therefore, for example, in the case where the driver depresses the accelerator pedal 10 by a relatively large stroke or returns the accelerator pedal 10 by a relatively large stroke during normal operation and then the stroke amount of the accelerator pedal 10 becomes relatively large, when the absolute value of the operation speed of the accelerator pedal 10 becomes relatively large and then the operation speed of the accelerator pedal 10 becomes equal to or higher than the quick operation determination threshold th1 that is changed by the threshold setting unit 123, the control unit 125 sets the rate of change in the power generated by the power source 20a higher than the normal rate of change. Therefore, for example, when the operation determination unit 124 determines that the driver has performed the operation of quickly depressing the accelerator pedal 10, the control unit 125 causes the power source 20a to generate a power larger than the power generated during normal control to thereby increase the driving force. On the contrary, when the operation determination unit 124 determines that the driver has performed the operation of quickly releasing the accelerator pedal 10, the control unit 125 causes the power source 20a to generate a power smaller than the power generated during normal control to thereby reduce the driving force. That is, when the operation determination unit 124 determines that the driver has performed the quick release operation, the control unit 125 causes the power

source 20a to generate a deceleration larger than, for example, a deceleration of the vehicle that is generated during normal control. As described above, at the time of quick depression or quick release, the control unit 125 makes the rate of change in the power generated by the power source 20a higher than the normal rate of change. Therefore, the vehicle running control apparatus 1 can make the responsiveness of the driving force at the time when the driver has quickly operated the accelerator pedal 10 higher than the responsiveness of the driving force during normal control.

[0059]

Further, in the vehicle running control apparatus 1 according to the first embodiment of the invention, the operation information detection unit 122 obtains the stroke amount of the accelerator pedal 10 on the basis of the difference between the initial opening degree and the above-mentioned final opening degree. Thus, the accuracy in detecting the stroke amount of the accelerator pedal 10 can be enhanced in comparison with a configuration in which the stroke amount of the accelerator pedal is obtained on the basis of the difference between the initial opening degree and the accelerator opening degree at the time when the operation speed of the accelerator pedal has reached the peak operation speed.

[0060]

Further, in the vehicle running control apparatus 1 according to the first

embodiment of the invention, the quick operation determination threshold th1 changed by the threshold setting unit 123 is so set as to increase as the stroke amount of the accelerator pedal 10, which is detected by the operation information detection unit 122, increases. Therefore, for example, even when the driver wants to control the power source 20a through normal control, the degree of reflection of the driver's intention on running of the vehicle can be enhanced in the case where the driver has operated the accelerator pedal 10. That is, in the vehicle running control apparatus 1 according to the first embodiment of the invention, even when the stroke amount of the accelerator pedal 10 becomes relatively large during normal operation, the control unit 125 controls the power source 20a through normal control when the operation speed of the accelerator pedal 10 is lower than the threshold th1. Thus, the vehicle running control apparatus 1 according to the first embodiment of the invention can more accurately cause running control of the vehicle to reflect the driver's intention of wanting to control the power source 20a through normal control than, for example, a vehicle running control apparatus that is configured to control the power source on the basis of only the operation speed of the accelerator pedal 10.

[0061]

[Second Embodiment] Next, a vehicle running control apparatus according to the second embodiment of the invention will be described. It should be noted herein

that the vehicle running control apparatus according to the second embodiment of the invention is characterized in determining whether or not the driver has performed the operation of quickly releasing the accelerator pedal 10 on the basis of the detected accelerator opening degree when the driver has cancelled depression of the accelerator pedal 10. In other respects, the vehicle running control apparatus 1 according to the second embodiment of the invention is identical in basic configuration to the vehicle running control apparatus 1 according to the first embodiment of the invention, so the description thereof is omitted.

[0062]

Hereinafter, in the second embodiment of the invention, a case where the operation information on the accelerator pedal 10 is an accelerator opening degree at the time when the driver starts operating the accelerator pedal 10 will be cited as an example, and a configuration of determining whether or not the driver has performed the operation of quickly releasing the accelerator pedal 10 on the basis of the detected accelerator opening degree when the driver has cancelled depression of the accelerator pedal 10 will be described.

[0063]

FIG. 7 includes timing charts showing changes over time in the accelerator opening degree, the operation speed of the accelerator pedal 10, and the quick release

determination flag in the vehicle running control apparatus according to the second embodiment of the invention. As indicated by (a) and (b) in FIG. 7, when the driver releases his/her foot from the accelerator pedal 10 and then the accelerator opening degree decreases (at a time t3), the accelerator opening degree detection unit 120 detects an initial opening degree as described above.

[0064]

FIG. 8 includes graphs showing changes over time in the operation speed and the accelerator opening degree in the case where the driver has released his/her foot from the accelerator pedal 10. As indicated by (a) and (b) in FIG. 8, when the driver has released his/her foot from the accelerator pedal 10, the accelerator opening degree detection unit 120 detects an initial opening degree, and then the operation information detection unit 122 directly handles this detected initial opening degree as a piece of operation information corresponding to a stroke amount.

[0065]

As shown in FIG. 7, when the operation information detection unit 122 detects a piece of operation information corresponding to a stroke amount of the accelerator pedal 10 on the basis of an accelerator opening degree detected by the accelerator opening degree detection unit 120, the threshold setting unit 123 sets the quick operation determination threshold th1 on the basis of the piece of the operation information on the

accelerator pedal 10, which is detected by the operation information detection unit 122.

[0066]

Then, the operation determination unit 124 determines whether or not the peak operation speed of the accelerator pedal 10 after detection of the accelerator opening degree by the accelerator opening degree detection unit 120 is equal to or higher than the threshold th1 to thereby determine whether or not the driver has performed the operation of quickly releasing the accelerator pedal 10. In this case, the operation determination unit 124 detects a peak operation speed of the accelerator pedal 10 from the absolute value of the operation speed of the accelerator pedal 10. That is, the peak operation speed in this case is a maximum value of the operation speed in a direction in which the accelerator pedal 10 is returned. As indicated by (b) in FIG. 7, when the peak operation speed of the accelerator pedal 10, which is detected by the operation speed detection unit 121, is equal to or higher than the threshold th1 set by the threshold setting unit 123, the operation determination unit 124 determines that the driver has performed the operation of quickly releasing the accelerator pedal 10.

[0067]

Then, upon determining that the driver has performed the operation of quickly releasing the accelerator pedal 10, the operation determination unit 124 sets the value of the quick release determination flag to 1, as indicated by (c) in FIG. 7. The quick

release determination flag is an operation determination flag at the time of quick release operation. Then, the control unit 125 operates the power source 20a through quick control on the basis of this set value of the quick release determination flag, namely, 1.

[0068]

More specifically, in performing the operation of quickly releasing the accelerator pedal 10, the driver mostly releases his/her foot from the accelerator pedal 10 until the accelerator pedal 10 is fully closed. When the driver performs the operation of quickly releasing the accelerator pedal 10 until the accelerator pedal 10 is fully closed, the accelerator opening degree assumes its minimum value, that is, becomes equal to 0% in a short period of time. Therefore, even when the operation information detection unit 122 does not obtain a difference between the initial opening degree and the final opening degree to detect a stroke amount of the accelerator pedal 10 from the absolute value of the difference as is the case with the vehicle running control apparatus 1 according to the first embodiment of the invention, it can detect a piece of information corresponding to a stroke amount of the accelerator pedal 10 from the accelerator opening degree itself at the time when the driver has performed the operation of quickly releasing the accelerator pedal 10, as shown in FIG. 8.

[0069]

Thus, in the vehicle running control apparatus 1 according to the second

embodiment of the invention, the operation information detection unit 122 uses an accelerator opening degree that is detected by the accelerator opening degree detection unit 120 when the driver has performed the operation of quickly releasing the accelerator pedal 10 as a piece of operation information on the accelerator pedal 10, instead of detecting a stroke amount of the accelerator pedal 10. Thus, the troublesomeness in calculating the stroke amount of the accelerator pedal 10 by the operation information detection unit 122, and a time lag resulting from calculation of the stroke amount of the accelerator pedal 10 can be eliminated. Accordingly, the vehicle running control apparatus 1 can promptly determine whether or not the driver has performed the operation of quickly releasing the accelerator pedal 10.

[0070]

[Third Embodiment] Next, a vehicle running control apparatus according to the third embodiment of the invention will be described. The vehicle running control apparatus according to the third embodiment of the invention is characterized by setting the quick operation determination threshold larger than a quick operation determination threshold in the case where the driver has additionally depressed the accelerator pedal 10, when the driver has depressed the fully closed accelerator pedal 10. In addition, the vehicle running control apparatus according to the third embodiment of the invention is identical in basic configuration to the vehicle running control apparatus 1 according to the

first embodiment of the invention, so the description thereof is omitted.

[0071]

Hereinafter, in the third embodiment of the invention, a case where the operation information on the accelerator pedal 10 is a piece of information indicating whether or not the driver has depressed the fully closed accelerator pedal 10 when the driver starts operating the accelerator pedal 10 will be described as a cited example.

[0072]

FIG. 9 includes timing charts showing changes over time in the accelerator opening degree, the operation speed of the accelerator pedal 10, and the quick depression determination flag in the vehicle running control apparatus according to the third embodiment of the invention. As indicated by (a) and (b) in FIG. 9, when the driver depresses the accelerator pedal 10 and then the accelerator opening degree increases (at a time t4), the accelerator opening degree detection unit 120 detects an initial opening degree. In this case, when the accelerator opening degree detection unit 120 detects that the initial opening degree is equal to 0%, that is, indicates a fully closed state, the operation information detection unit 122 detects a piece of information indicating that the driver has depressed the fully closed accelerator pedal 10, on the basis of a result of detection by the accelerator opening degree detection unit 120.

[0073]

Then, when the operation information detection unit 122 has detected such a piece of operation information, the threshold setting unit 123 sets a quick operation determination threshold th3, which is larger than a quick operation determination threshold th2 in the case where the driver has additionally depressed the accelerator pedal 10, on the basis of this detected piece of the operation information.

[0074]

Then, the operation speed detection unit 121 detects a maximum value of the operation speed in a direction in which the accelerator pedal 10 is depressed as a peak operation speed in the determination period T for determining whether or not the driver has quickly operated the accelerator pedal 10. Furthermore, the operation determination unit 124 determines whether or not the peak operation speed detected by the operation speed detection unit 121 is equal to or higher than a threshold th3 set by the threshold setting unit 123. That is, the operation determination unit 124 determines whether or not the driver has performed the operation of quickly depressing the accelerator pedal 10. Then, even when the peak operation speed detected by the operation speed detection unit 121 is equal to or higher than the threshold th2, the operation determination unit 124 sets the value of the quick depression determination flag to 0 as indicated by (c) in FIG. 9, upon determining that the peak operation speed is lower than the threshold th3 set by the threshold setting unit 123.

[0075]

In this case, the control unit 125 operates the power source 20a through normal control on the basis of the value of the quick depression determination flag set by the operation determination unit 124, namely, 0.

[0076]

Further, upon determining that the peak operation speed detected by the operation speed detection unit 121 is equal to or higher than the threshold th3 set by the threshold setting unit 123, the operation determination unit 124 sets the value of the quick depression determination flag to 1. In this case, the control unit 125 operates the power source 20a through quick control on the basis of the value of the quick depression determination flag set by the operation determination unit 124, namely, 1.

[0077]

The vehicle running control apparatus 1 according to the third embodiment of the invention operates as described above. Therefore, for example, in the case where the driver intends to generate a driving force through normal control, when the operation speed of the accelerator pedal 10 has become higher than at the time of additional depression of the accelerator pedal 10 due to the depression from a state where the driver keeps his/her foot off the accelerator pedal 10, the operation determination unit 124 determines that the driver has not performed the operation of quickly depressing the

accelerator pedal 10 as long as the peak operation speed of the accelerator pedal 10 is lower than the threshold th3 even if it has become higher than the pre-change threshold th2. In such a case, the control unit 125 cause the power source 20a to be driven through normal control instead of causing it to be driven through quick control, on the basis of the result of the determination made by the operation determination unit 124.

[0078]

That is, even when the driver depresses the accelerator pedal 10 from a fully closed state, the ECU 12 can cause driving force control for the power source 20a to reflect the driver's intention of wanting to generate a driving force through normal control. That is, in the case where the driver intends to generate a driving force through normal control, even when the operation speed of the accelerator pedal 10 becomes higher than a normal speed at the time of additional depression due to the depression from a state where the driver keeps his/her foot off the accelerator pedal 10, the vehicle running control apparatus 1 according to the third embodiment of the invention can cause the vehicle to run through normal control. Thus, the vehicle running control apparatus 1 according to the third embodiment of the invention can enhance the degree of reflection of the driver's intention on running of the vehicle when the driver has operated the accelerator pedal 10.

[0079]

[Modification Examples] It should be noted that the vehicle running control apparatus 1 according to each of the first to third embodiments of the invention may control the transmission 20b instead of controlling the power source 20a through driving force control at the time of quick depression or quick release of the accelerator pedal 10. In this case, the vehicle running control apparatus 1 changes the contents of control for the transmission 20b by the control unit 125 in accordance with a result of a determination made by the operation determination unit 124.

[0080]

That is, the operation determination unit 124 sets the quick operation determination threshold on the basis of the operation information on the accelerator pedal 10, which is detected by the threshold setting unit 123, and determines whether or not the peak operation speed is equal to or higher than this set threshold. When the operation determination unit 124 determines that the driver has performed the operation of quickly depressing or quickly releasing the accelerator pedal 10 as quick operation of the accelerator pedal 10, the control unit 125 changes the contents of the control for the transmission 20b in accordance with a result of this determination. When the operation determination unit 124 determines that the driver has performed the operation of quickly depressing or quickly releasing the accelerator pedal 10, the control unit 125 shifts, for example, a gear selected in the transmission 20b to a gear that is lower in rotational speed

than a gear selected through normal control. Thus, for example, the vehicle running control apparatus 1 can accelerate or decelerate the vehicle by a larger value than in the case where the transmission 20b is controlled through normal control. That is, the vehicle running control apparatus 1 can more accurately cause running control of the vehicle to reflect the driver's intention than, for example, a vehicle running control apparatus that is configured to control the transmission of the driving force generation device on the basis of only the operation speed of the accelerator pedal. That is, the vehicle running control apparatus 1 can enhance the degree of reflection of the driver's intention on running of the vehicle when the driver has operated the accelerator pedal 10.

[0081]

Further, the vehicle running control apparatus 1 according to the invention may be a combination of two or more of the vehicle running control apparatuses 1 described in the first to third embodiments of the invention. For example, when the driver returns the accelerator pedal 10, the vehicle running control apparatus 1 according to the invention may perform the driving force control process for the power source 20a described in the first embodiment of the invention or the driving force control process for the power source 20a described in the second embodiment of the invention distinctly on the basis of whether or not the accelerator opening degree is equal to or higher than a set value (e.g., an accelerator opening degree of 50%). Thus, in the case of the above

setting, when the accelerator opening degree is equal to or higher than the set value, the operation determination unit 124 determines whether or not the driver has performed the operation of quickly releasing the accelerator pedal 10 according to the control procedure described in the first embodiment of the invention. On the contrary, when the accelerator opening degree is lower than the aforementioned set value, the operation determination unit 124 predicts that the driver releases his/her foot from the accelerator pedal 10 to fully close the accelerator pedal 10 and then determines that the accelerator pedal 10 is fully closed, through the driving force control process described in the second embodiment of the invention. As described above, the operation determination unit 124 may make a determination on the operation of the accelerator pedal 10, and the control unit 125 may control the power generated by the power source 20a in accordance with the result of a determination made by the operation determination unit 124.

[0082]

Incidentally, in the case where the driver performs the operation of quickly depressing or quickly releasing the accelerator pedal 10, even if a shock such as vibrations or the like somewhat occurs in the vehicle, the driver wants to prompt quick response as a response of the vehicle to quick operation of the accelerator pedal 10 in many cases. Then, for example, when the operation determination unit 124 determines that the driver has performed the operation of quick depression or quick release, the

control unit 125 may change the contents of the control for the power source 20a so as to increase the responsiveness of the power generated by the power source 20a. In this case, for example, in the case of a vehicle in which quick response has been reduced to prevent a shock such as vibrations or the like from occurring in the vehicle in normal control, the control unit 125 can allow a shock such as vibrations or the like to occur in the vehicle to enhance quick response, when the operation determination unit 124 determines that the driver has performed the operation of quick depression or quick release.

[0083]

Further, in the vehicle running control apparatus 1 according to each of the first to third embodiments of the invention, the case where the accelerator operator is the accelerator pedal 10 has been described. However, the accelerator operator is not limited to the accelerator pedal 10. The accelerator operator may be an operator such as a lever, a grip, or the like.

[0084]

Further, in the vehicle running control apparatus 1 described above, a brake operator such as a brake pedal or the like may be applied instead of the accelerator operator. In this case, the vehicle running control apparatus 1 determines, by means of the operation determination unit 124, whether or not the driver has quickly operated the

brake operator, and can change, by means of the control unit 125, the contents of control for a braking device mounted on the vehicle. For example, in the vehicle running control apparatus 1 to which a brake pedal is applied instead of the accelerator operator, when the driver has performed the operation of quickly depressing the brake pedal, the control unit 125 can make the rate of change in the braking force of the vehicle generated by the braking device higher than a rate of change in the braking force of the vehicle during normal control. That is, the vehicle running control apparatus 1 can further increase the braking force of the vehicle when the driver has performed the operation of quickly depressing the brake pedal. In this manner, the vehicle running control apparatus 1 to which the brake operator is applied instead of the accelerator operator can change the contents of the control for the braking device on the basis of the driver's intention.

[INDUSTRIAL APPLICABILITY]

[0085]

As described above, the vehicle running control apparatus according to the invention is useful as a vehicle running control apparatus that enhances the degree of reflection of a driver's intention on running of a vehicle.

[DESCRIPTION OF THE REFERENCE NUMERALS]

[0086]

1 VEHICLE RUNNING CONTROL APPARATUS

10 ACCELERATOR PEDAL (ACCELERATOR OPERATOR)

12 ECU

123 THRESHOLD SETTING UNIT

124 OPERATION DETERMINATION UNIT

125 CONTROL UNIT