[Designation of Document] Abstract

[Abstract]

[Problem]

To provide an idling stop control device for a motorcycle which takes into an account starting of an engine by kick starting, push starting or the like peculiar to a two-wheeled vehicle.

[Means for Resolution]

In an idling stop control device for a motorcycle which performs an idling stop control where an engine is automatically stopped when a predetermined stop condition is established, and the engine 14 is automatically restarted by a self-starter motor 44 using power of a battery 43 when a predetermined start condition is established, the idling stop control device includes: a starting method determination means 312 which determines whether or not the engine 14 is started by a means other than the self-starter motor 44, and the idling stop control is inhibited regardless of the stop condition when the starting method determination means 312 determines that the engine 14 is started by the means other than the self-starter motor 44.

[Selected Drawing] Fig. 2

[Designation of Document] Claims

[Claim 1]

An idling stop control device for a motorcycle which performs an idling stop control where an engine is automatically stopped when a predetermined stop condition is established, and the engine (14) is automatically restarted by a self-starter motor (44) using power of a battery (43) when a predetermined start condition is established, wherein

the idling stop control device comprises: a starting method determination means (312) which determines whether or not the engine (14) is started by a means other than the self-starter motor (44), and the idling stop control is inhibited regardless of the stop condition when the starting method determination means (312) determines that the engine (14) is started by the means other than the self-starter motor (44).

[Claim 2]

The idling stop control device for a motorcycle according to claim 1, wherein the idling stop control device further comprising:

a generator (41) which is rotated in synchronism with the engine (14);

an ECU (31) which is operated with power supplied from the generator (41) and power supplied from the

battery (43) and controls the self-starter motor (44),

a crank pulse generating means (42) which generates crank pulses synchronized with the rotation of a crankshaft of the engine (14); and

a crank pulse counting means (311) which counts the crank pulses, wherein

the ECU (31), when a power supply state is changed from a state where power is not supplied to a state where power is supplied, firstly executes initial processing, and advances to a state where the self-starter motor (44) is controllable after the initial processing is finished, and

the starting method determination means (312) determines that the engine (14) is started by a means other than the self-starter motor (44) when the crank pulse counting means (311) detects crank pulses during a period where the ECU (31) executes the initial processing.

[Claim 3]

The idling stop control device for a motorcycle according to claim 2, wherein the idling stop control device further comprises a battery voltage determination means (313) which determines a terminal voltage of the battery (43) after the ECU (31) advances to the state where the self-starter motor (44) is controllable,

the battery voltage determination means (313)

determines whether or not the terminal voltage of the battery (43) is equal to or below a self-starter motor startable voltage, and

the idling stop control is inhibited when the battery voltage determination means (313) determines that the terminal voltage of the battery (43) is equal to or below the self-starter motor startable voltage.

[Claim 4]

The idling stop control device for a motorcycle according to claim 2 or 3, wherein the initial processing is processing which the ECU (31) executes firstly after a power source of the ECU (31) is turned on.

Dated this 26 day of March 2013

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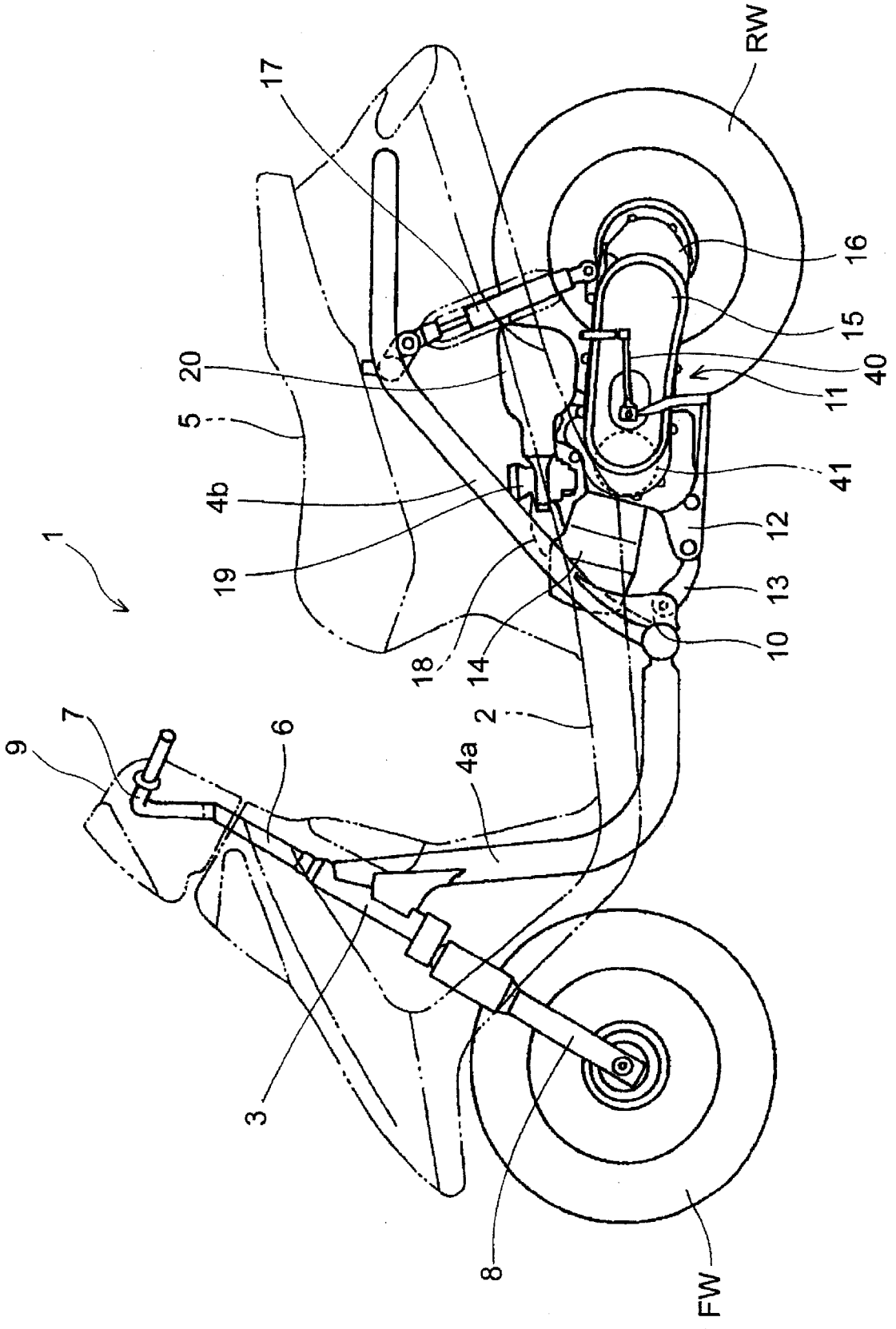
[Designation of Document] Drawings

[Fig. 1]



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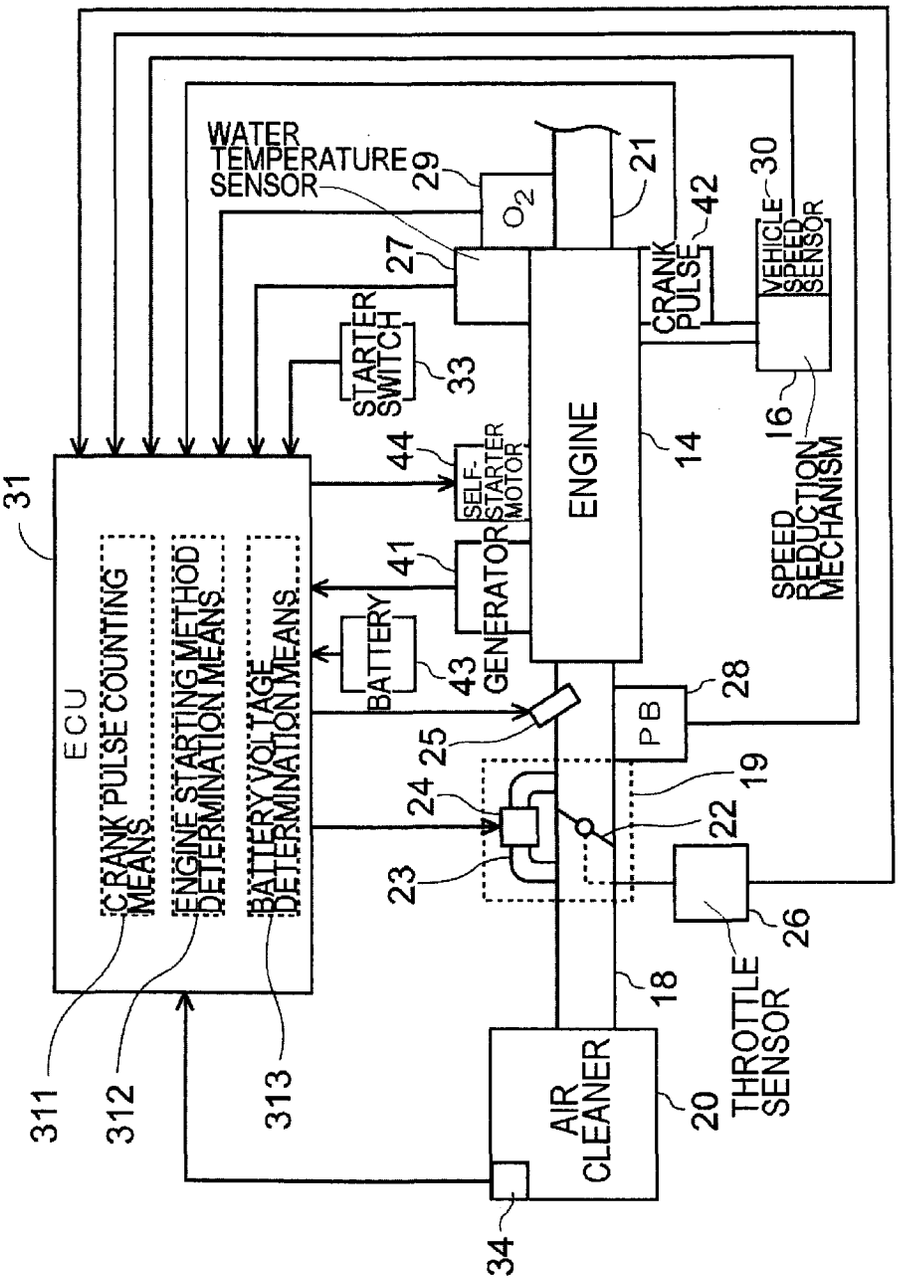
[Fig. 2]



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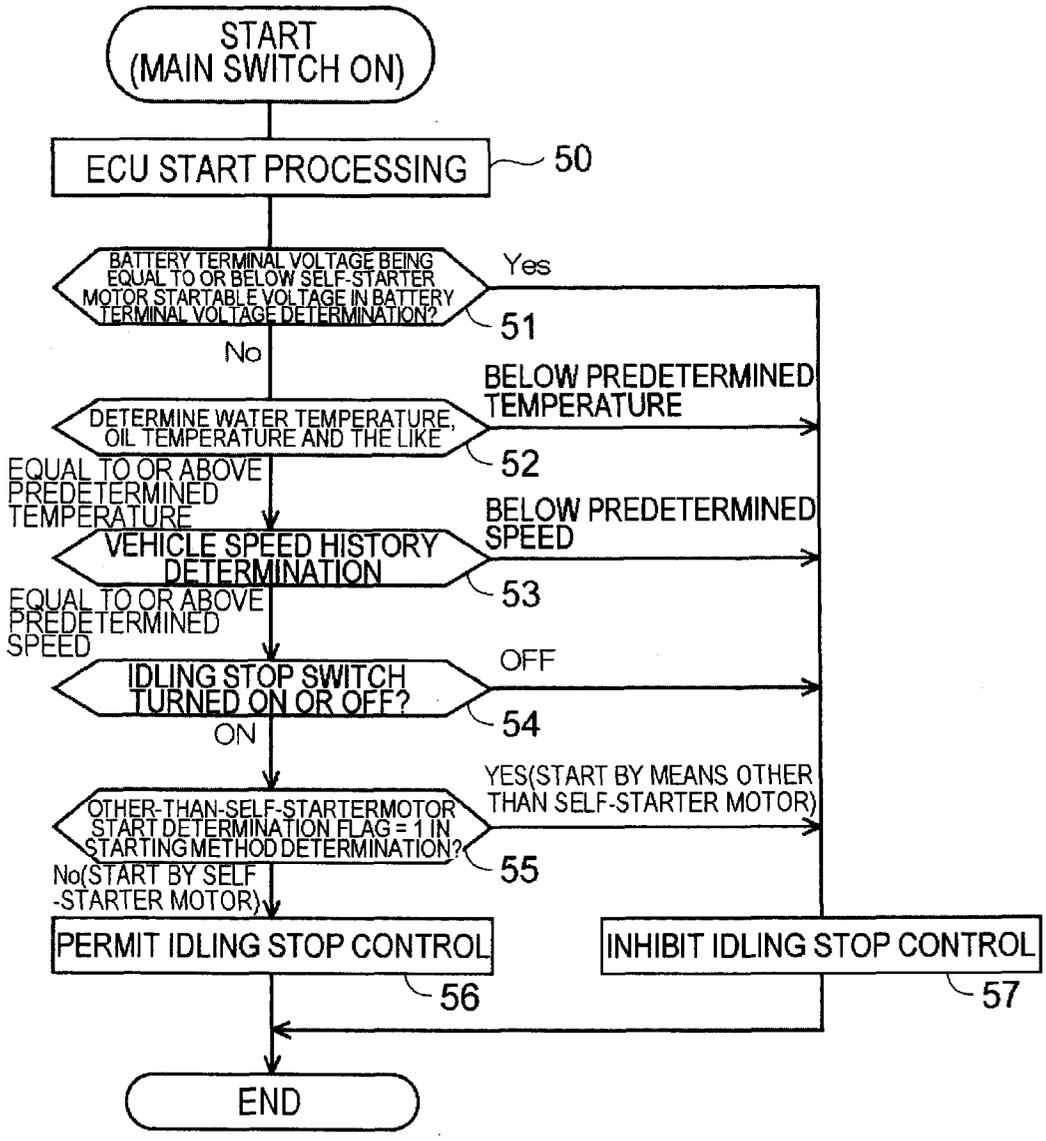
[Fig. 3]



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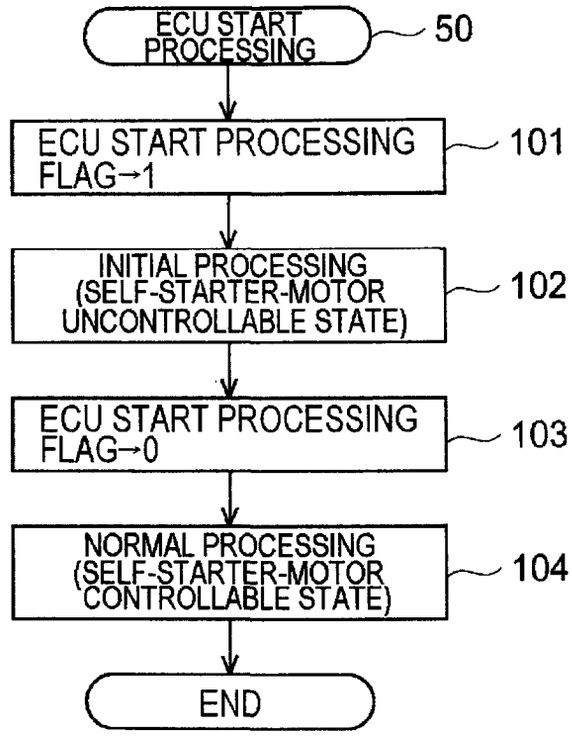
[Fig. 4]



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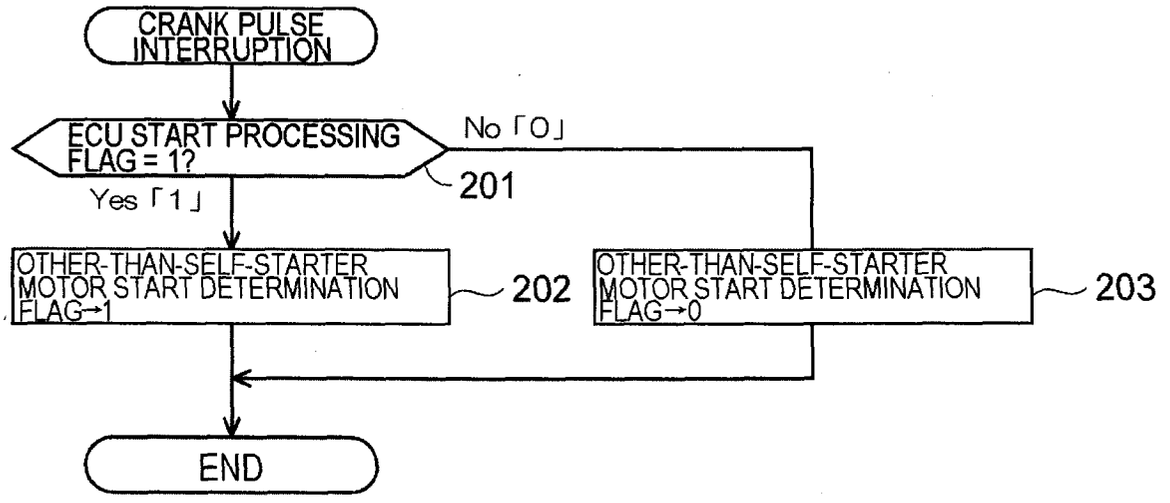
[Fig. 5]



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"Translation for application"

[Designation of Document] Specification

[Title of the Invention] Idling Stop Control Device for Motorcycle

[Technical Field]

[0001]

The present invention relates to an engine control device which automatically stops an engine when a predetermined stop condition is established and automatically restarts the engine when a predetermined start condition is established, and more particularly to an idling stop control device for a motorcycle suitable for an idling stop control of the motorcycle.

[Background Art]

[0002]

Conventionally, in performing an idling stop control of an engine, for example, as described in patent literature 1, there has been proposed a control where a battery voltage during an idling stop (idling being stopped) is determined, and the engine is automatically started when the voltage reaches a lower limit necessary for starting the engine thus preventing the engine from falling into a state of being incapable to restart.

[Citation List]

[Patent Literature]

[0003]

[Patent Literature 1] JP-A-2001-227375

[Summary of the Invention]

[Problems that the Invention is to Solve]

[0004]

According to the above-mentioned technique, it is possible to prevent the engine from falling into a state of being incapable to restart by automatically starting the engine when the voltage is low after determining the battery voltage during the idling stop. In the case of a motorcycle, however, even when a battery voltage is low so that starting of the engine cannot be performed using a self-starter motor, there may be a case where the engine is started by a kick lever, push starting of a vehicle or the like. In the case of such a vehicle, however, when a battery voltage is detected after engine is started by kick starting or push starting and only after the vehicle is brought into an idling stop as in the case of the prior art, it is often the case that even when it is found that a battery voltage is low, the battery voltage is equal to or below a voltage at which the engine can be automatically started by a self-starter motor. As a result, to avoid a state where kick starting or push starting must be performed each time the engine is brought into an idling stop, it is necessary to take a

countermeasure such as the increase in a battery capacitance. This countermeasure, however, gives rise to a drawback that the vehicle becomes large-sized.

[0005]

On the other hand, it may be possible to adopt a countermeasure where a battery voltage is detected when an engine is being operated and an idling stop is not performed when a detected voltage is a battery voltage at which the engine cannot be restarted. In this case, however, when the engine is being operated, a generated voltage of a generator is applied to a battery side and hence, the detected battery voltage exhibits a value higher than a voltage of the battery per se and hence, it is difficult to detect the battery voltage per se whereby there exists a drawback that it is necessary to adopt a complicated system for detection.

[0006]

The present invention has been proposed in view of the above-mentioned circumstances, and it is an object of the present invention to provide an idling stop control device for a motorcycle which takes into an account starting of an engine by kick starting, push starting or the like peculiar to a two-wheeled vehicle.

[Means for Solving the Problem]

[0007]

To achieve the above-mentioned object, claim 1 is directed to an idling stop control device for a motorcycle which performs an idling stop control where an engine is automatically stopped when a predetermined stop condition is established, and the engine (14) is automatically restarted by a self-starter motor (44) using power of a battery (43) when a predetermined start condition is established, wherein the idling stop control device is characterized by having the following constitutions.

The idling stop control device includes: a starting method determination means (312) which determines whether or not the engine (14) is started by a means other than the self-starter motor (44), and the idling stop control is inhibited regardless of the stop condition when the starting method determination means (312) determines that the engine (14) is started by the means other than the self-starter motor (44).

[0008]

The idling stop control device for a motorcycle according to claim 2 is, in the idling stop control device for a motorcycle according to claim 1, characterized in that the idling stop control device further includes a generator (41) which is rotated in synchronism with the engine (14); an ECU (31) which is operated with power supplied from the generator (41) and power supplied from

the battery (43) and controls the self-starter motor (44), a crank pulse generating means (42) which generates crank pulses synchronized with the rotation of a crankshaft of the engine (14); and a crank pulse counting means (311) which counts the crank pulses.

The ECU (31), when a power supply state is changed from a state where power is not supplied to a state where power is supplied, firstly executes initial processing, and advances to a state where the self-starter motor (44) is controllable after the initial processing is finished.

The initial processing executed by the ECU (31) includes the initialization of a microcomputer, checking of a ROM and a RAM, the permission of interruption, and the initialization of variables (RAM), and sensor inputs and a motor command cannot be outputted until the processing is completed so that a control of the self-starter motor (44) becomes impossible during the initial processing.

The starting method determination means (312) determines that the engine (14) is started by a means other than the self-starter motor (44) when the crank pulse counting means (311) detects crank pulses during a period where the ECU (31) executes the initial processing.

[0009]

The idling stop control device for a motorcycle

according to claim 3 is, in the idling stop control device for a motorcycle according to claim 2, characterized in that the idling stop control device further comprises a battery voltage determination means (313) which determines a terminal voltage of the battery (43) after the ECU (31) advances to the state where the self-starter motor (44) is controllable, the battery voltage determination means (313) determines whether or not the terminal voltage of the battery (43) is equal to or below a self-starter motor startable voltage, and the idling stop control is inhibited when the battery voltage determination means (313) determines that the terminal voltage of the battery (43) is equal to or below the self-starter motor startable voltage.

[0010]

The idling stop control device for a motorcycle according to claim 4 is, in the idling stop control device for a motorcycle according to claim 2 or claim 3, characterized in that the initial processing is processing which the ECU (31) executes firstly after a power source of the ECU (31) is turned on.

[Advantage of the Invention]

[0011]

According to the constitution called for in claim 1, when the engine is started by the means other than the

self-starter motor (44), the idling stop is inhibited regardless of the stop condition. Accordingly, in a state where a large battery cannot be mounted or the self-starter motor (44) cannot be started with a battery voltage, it is possible to avoid a situation where it is necessary to start the engine by a means other than the self-starter motor (44) such as kick starting or push starting each time a rider waits for a change of a stoplight or the like with a simple control technique without adopting a complicated system which detects a voltage of only a battery to which a voltage of a generator is applied.

[0012]

According to the constitution called for in claim 2, starting of the engine by the means other than the self-starter motor (44) can be determined with the simple constitution by detecting the presence or the non-presence of crank pulses by the crank pulse counting means (311).

[0013]

According to the constitution called for in claim 3, the idling stop control is inhibited when the battery terminal voltage is simply low regardless of the supply of power from the generator (41) to the battery (43) and hence, an idling stop control can be inhibited more reliably.

[0014]

According to the constitution called for in claim 4, the ECU (31) can finish the initial processing with the completion of the processing executed firstly.

[Brief Description of the Drawings]

[0015]

[Fig. 1]

An explanatory side view of a motorcycle on which an idling stop control device for a motorcycle according to one embodiment of the present invention is mounted.

[Fig. 2]

An explanatory system constitutional view of the idling stop control device for a motorcycle according to one embodiment of the present invention.

[Fig. 3]

A flowchart showing steps of an engine stop control executed by an idling stop control device for a motorcycle.

[Fig. 4]

A flowchart showing steps of ECU start processing executed by the idling stop control device for a motorcycle.

[Fig. 5]

A flowchart showing steps of processing when the crank pulse interruption is made during the ECU start

processing.

[Mode for Carrying Out the Invention]

[0016]

Hereinafter, one embodiment of the present invention is explained in conjunction with drawings. Fig. 1 is a side view of the whole constitution of a scooter-type motorcycle on which an idling stop control device for a motorcycle according to one embodiment of the present invention is mounted.

The idling stop control device is a device which automatically stops an engine when a drive force is unnecessary, and automatically starts the engine when the drive force is necessary thus realizing low fuel consumption and also the reduction in the generation of an exhaust gas.

[0017]

A vehicle-body front portion and a vehicle-body rear portion of a motorcycle 1 are connected to each other by way of a low floor portion 2, and a vehicle body frame which forms a skeleton of the vehicle body is constituted of a head pipe 3 at a front portion of the vehicle body, a down tube 4a which extends downward and rearward from the head pipe 3, and a main pipe 4b. A fuel tank and a storage box (neither of which being shown in the drawing) are supported on the main pipe 4b, and a seat 5 is

arranged above the fuel tank and the storage box.

[0018]

A steering shaft 6 penetrates the head pipe 3 in the vertical direction and is rotatably supported by the head pipe 3, and a steering handle 7 is mounted on an upper portion of the steering shaft 6, and a front fork 8 is mounted on a lower portion of the steering shaft 6. A front wheel FW is pivotally mounted on a lower end of the front fork 8. An upper portion of the steering handle 7 is covered with a handle cover 9 which also functions as an instrument panel. A bracket 10 is mounted on a lower end of a raised portion of the main pipe 4b in a projecting manner, and a hanger bracket 12 of a swing unit 11 is swingably connected and supported on the bracket 10 by way of a link member 13.

[0019]

A single-cylinder 4-cycle engine 14 is mounted on a front portion of the swing unit 11. A belt-type continuously variable transmission 15 is connected to the engine 14 by way of a centrifugal clutch not shown in the drawing, and a speed reduction mechanism 16 is connected to a driven side of the belt type continuously variable transmission 15. A rear wheel RW is pivotally supported on an output shaft of the speed reduction mechanism 16.

Further, the engine 14 is configured to be startable

when the output shaft is rotated by a rider kicking a kick lever 40.

[0020]

A rear cushion 17 is interposed between the speed reduction mechanism 16 and the main pipe 4. An intake pipe 18 is pulled out from a front portion of the engine 14, bends and extends toward a rear side of the vehicle body. A throttle body 19 which incorporates a throttle valve and an air supply device such as an IACV or a starting solenoid valve therein is mounted on the intake pipe 18. An air cleaner 20 is connected to a rear portion of the throttle body 19. A fuel injection valve (see Fig. 2) is mounted on the intake pipe 18 between the engine 14 and the throttle body 19.

[0021]

On the steering handle 7 of the motorcycle 1, a main switch (not shown in the drawing) which supplies a battery power source to electric equipment mounted on the vehicle and an idling stop switch (not shown in the drawing) which manually selects whether or not an idling stop control of the engine 14 is to be performed are arranged.

An acceleration grip not shown in the drawing is mounted on a right end portion of the steering handle 7. The acceleration grip is mounted on an end portion of a pipe member which forms the steering handle 7 in a

rotatably manipulable manner.

[0022]

Fig. 2 is a system constitutional view of the idling stop control device (engine control device) for a motorcycle according to this embodiment. In the drawing, symbols which are equal to the symbols used in Fig. 1 indicate identical or similar parts.

The intake pipe 18 and an exhaust pipe 21 are mounted on the engine 14. On the throttle body 19 which is mounted on the intake pipe 18, the throttle valve 22, a bypass passage 23 which bypasses the throttle valve 22 and is connected to the intake pipe 18 on both sides of the throttle valve 22, and an air supply device 24 which opens or closes the bypass passage 23 are mounted. The fuel injection valve 25 is mounted on the intake pipe 18 between the engine 14 and the throttle body 19.

At a position adjacent to the engine 14, a generator 41 which is rotated in synchronism with the engine 14, a crank pulse detection sensor 42 which generates crank pulses synchronized with the rotation of a crankshaft of the engine 14, and a self-starter motor 44 which is driven by a voltage supplied from a battery 43 are arranged.

[0023]

The throttle valve 22 is rotated corresponding to a rotary manipulation of the acceleration grip, and a

rotational amount (angle) of the throttle valve 22 is detected by a throttle sensor 26. A water temperature sensor 27 which detects a temperature of engine cooling water is mounted on the engine 14, and a PB sensor 28 which detects an intake negative pressure is mounted on the intake pipe 18. An O_2 sensor 29 which detects the oxygen concentration in an exhaust gas is mounted on an engine head or the exhaust pipe 21. By mounting the O_2 sensor 29 on the exhaust pipe 21 in the vicinity of the engine or on the engine head, the O_2 sensor 29 may be formed of a sensor which does not require a heater. Further, a vehicle speed sensor 30 is provided which detects a vehicle speed based on a rotational speed of an output gear of the speed reduction mechanism 16.

Further, an atmospheric pressure sensor 34 is mounted on the air cleaner 20 at a position remote from the intake pipe 18. An atmospheric pressure may be estimated based on a detection output of the PB sensor 28 while eliminating the atmospheric sensor 34.

[0024]

Detection signals from the throttle sensor 26, the water temperature sensor 27, the PB sensor 28, the O_2 sensor 29, and the crank pulse detection sensor 42, and an engine start signal and an engine stop signal from a starter switch 33 are inputted to an engine control device

(ECU) 31 having a microcomputer (CPU). The starter switch 33 is a switch which starts the engine 14 by rotating a self-starter motor 44 with a power source of the battery 43 by manipulating an ignition key.

The ECU 31 is operated with power supplied from the generator 41 and power supplied from the battery 43, controls the self-starter motor 44 and, based on the inputted detection signals, calculates what degree the air supply device 24 is opened and the amount of fuel injected by the fuel injection valve 25 and outputs control signals to the air supply device 24 and the fuel injection valve 25.

[0025]

Further, the ECU 31 has an idling stop control function where the ECU 31 stops the engine 14 when a predetermined stop condition such as a condition where a vehicle speed detected by the vehicle speed sensor 30 is zero or a predetermined speed and below or a condition that throttle opening detected by the throttle sensor 26 is zero or a predetermined value or below is satisfied and, thereafter, the engine 14 is started when a predetermined idling stop start condition such as a condition that the throttle valve is opened is satisfied. During the engine stop in the idling stop control, only the fuel supply by the fuel injection valve 25 is stopped, and an ignition

operation by an igniter not shown in the drawing is continuously performed.

[0026]

Further, the ECU 31 includes a crank pulse counting means 311 which counts crank pulses detected by the crank pulse detection sensor 42, an engine starting method determination means 312 which determines a starting method of the engine, and a battery voltage determination means 313 which determines a terminal voltage of the battery 43.

When a power supply state is changed from a state where power is not supplied to a state where power is supplied, the ECU 31 firstly executes initial processing and, after the initial processing is finished, a control is performed such that the ECU 31 advances to a state where the self-starter motor 44 is controllable. The initial processing of the ECU 31 includes the initialization of a microcomputer, checking of a ROM and a RAM, the permission of interruption, and the initialization of variables (RAM), and sensor inputs and a motor command cannot be outputted until the processing is completed. Accordingly, the control of the self-starter motor 44 is impossible during the initial processing.

Then, when the crank pulse counting means 311 detects crank pulses from the crank pulse detection sensor 42 during an initial processing, the engine starting

method determination means 312 determines that the engine 14 is started by a means other than the self-starter motor 44. The case where the engine 14 is started by the means other than the self-starter motor 44 is a case where the engine 14 is started by the kick lever 40 or vehicle push starting in a vehicle employing a non-centrifugal manual clutch.

The battery voltage determination means 313 is provided for determining whether or not a terminal voltage is equal to or below a self-starter motor startable voltage after detecting the terminal voltage of the battery 43.

[0027]

Although the ECU 31 also has functions other than the control of the air supply device 24 and the fuel injection valve 25 and the idling stop control (for example, the control of ignition timing of the igniter or the like), these functions are not essential parts of the present invention and hence, the explanation of these functions is omitted.

[0028]

Next, the idling stop control performed by the ECU 31 is explained in conjunction with flowcharts shown in Fig. 3 to Fig. 5.

[0029]

Firstly, when an ON manipulation of a main switch of the vehicle is performed, ECU start processing is performed (step 50). The ECU start processing is performed when a power supply state is changed from a state where power is not supplied to the ECU 31 to a state where power is supplied to the ECU 31. The ECU start processing is performed when the main switch of the vehicle is brought into an ON state from an OFF state in the case of a normal time where there is some amount of charge remaining in the battery, and is performed after a crankshaft is rotated by a kick or the like so that an output of the generator is supplied to the battery in the case where there is no charge remaining in the battery.

[0030]

In performing the ECU start processing (step 50), as shown in Fig. 4, firstly, an ECU start processing flag is put up (the flag is put up to "1") (step 101).

Next, the initial processing where the self-starter motor 44 is brought into an uncontrollable state during a predetermined period is performed (step 102). In the initial processing, it is determined whether or not the crank pulse counting means 311 detects a crank pulse (crank pulse interruption) during a predetermined period.

[0031]

When the crank pulse interruption is made, as shown

in Fig. 5, firstly, a value of the ECU start processing flag is determined (step 201). When the ECU start processing flag is "1", a value of an other-than-self-starter-motor starting determination flag is put up to "1" (step 202). When the ECU start processing flag is "0", the initial processing is not underway and hence, the value of the other-than-self-starter motor starting determination flag is put up to "0" (step 202).

When the crank pulse is detected in the initial processing (when the other-than-self-starter motor starting determination flag is put up to "1"), such a case is a state immediately after a remaining charge in the battery is small so that the ECU 31 cannot be started even when the main switch is turned on whereby the generator supplies power to the ECU 31 due to the rotation of the output shaft of the engine 14 (by the manipulation of the kick lever 40 or push starting) without using the self-starter motor 44. Accordingly, the ECU 31 determines that the engine 14 is started with a means other than the self-starter motor 44, and the ECU 31 stores a fact that the engine 14 is started by the means other than the self-starter motor 44.

[0032]

After the initial processing is finished, the ECU start processing flag is put down (set to "0") (step 103)

so that the processing advances to a normal state where the self-starter motor 44 is controllable (self-starter motor controllable state) (step 104). By executing the initial processing as the processing which the ECU 31 executes firstly after the power source of the ECU 31 is turned on, the initial processing can be finished with the completion of the firstly executed processing and hence, the processing can be made to readily advance to an ECU normal state.

[0033]

After the ECU 31 advances to a controllable state, the battery voltage determination means 313 which determines a terminal voltage of the battery determines whether or not the terminal voltage of the battery 43 is equal to or below a self-starter motor startable voltage (step 51). When the battery voltage determination means 313 determines that the terminal voltage of the battery 43 is the self-starter motor startable voltage or below, the idling stop control is inhibited (step 57).

By executing such processing, regardless of whether or not power supplied from the generator 41 is supplied to the battery 43, the idling stop control is inhibited simply when the battery terminal voltage is low and hence, the idling stop control can be inhibited more reliably.

[0034]

When the battery voltage determination means 313 determines that a terminal voltage of the battery exceeds a self-starter motor startable voltage in step 51, a water temperature, an oil temperature and the like in the engine 14 are detected, and when the detected temperature is a predetermined temperature or above, the processing advances to next step (step 52). When the detected temperature is below the predetermined temperature, battery voltage determination means 313 determines that an idling operation of the engine 14 is underway and the idling stop control is inhibited (step 57).

[0035]

Next, the ECU 31 determines a vehicle speed history, and detects whether or not a vehicle speed becomes a predetermined speed (for example, 10km/h) even one time after the main switch is turned on. When the vehicle speed becomes the predetermined speed or more, the processing advances to next step (step 53). The ECU 31 stores the vehicle speed history after receiving a signal from the vehicle speed sensor 30 and determining whether or not the vehicle speed becomes the predetermined speed or more. When the vehicle speed does not reach the predetermined speed even one time, the ECU 31 determines that the engine 14 is in a state before traveling although the engine 14 is being operated, and inhibits the idling

stop control (step 57).

[0036]

Turning on or off of an idling stop switch by which whether or not an idling stop control is to be performed is selected manually is detected. When it is detected that the idling stop switch is turned on, the processing advances to next step (step 54). When the idling stop switch is turned off, the idling stop control is inhibited (step 57).

[0037]

Subsequently, a starting method of the engine 14 is determined by the engine starting method determination means 312. In this determination, in the initial processing in step 50, when the detection of a crank pulse by the crank pulse counting means 311 is stored (when a starting determination flag is put up to "1" in step 202 in the flowchart shown in Fig. 5), it is determined that the engine 14 is started by a starting method other than the self-starter motor 44 (step 55), and the idling stop control is inhibited (step 57).

[0038]

When the crank pulse counting means 311 does not detect a crank pulse, it is determined that the engine 14 is started by the self-starter motor 44 (step 55), and the ECU 31 permits an idling stop control (step 56). That is,

the idling stop control is permitted only when all conditions consisting of the condition (1) that a water temperature and the like in the engine 14 are a predetermined temperature or above, the condition (2) that a vehicle speed has become a predetermined speed or above one time or more, the condition (3) that the idling stop switch is in an ON state, and the condition (4) that the engine 14 is started by the self-starter motor 44 are satisfied.

[0039]

According to the above-mentioned processing, when the engine is started by a means other than the self-starter motor 44, the idling stop is inhibited regardless of the stop condition.

Accordingly, when the engine 14 is started by a kick manipulation or push starting in a state where the self-starter motor 44 cannot be started by a battery voltage, the idling stop is inhibited so that the engine 14 is not stopped whereby, using a simple control technique, it is possible to avoid a situation where it is necessary to start the engine by a means other than the self-starter motor such as kick starting or push starting each time a rider waits for a change of a stoplight or the like.

[0040]

Further, by detecting the presence or the non-

presence of a crank pulse by the crank pulse counting means 311, starting of the engine by a means other than the self-starter motor 44 (kick manipulation or push starting) can be determined with the simple constitution.

[Description of Reference Numerals and Signs]

[0041]

1: motorcycle, 14: engine, 18: intake pipe, 19: throttle body

22: throttle valve, 24: air supply device, 26: throttle sensor, 27: water temperature sensor, 29: O_2 sensor, 31: ECU, 33: starter switch, 40: kick lever, 41: generator, 42: crank pulse detection sensor, 43: battery, 44: self-starter motor, 311: crank pulse counting means, 312: engine starting method determination means, 313: battery voltage determination means