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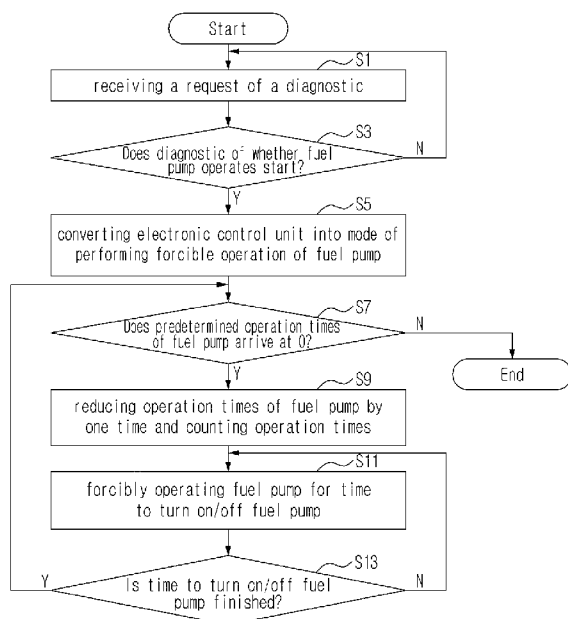
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(54) Title: METHOD OF PROVIDING FUEL TO FUEL LINE WHEN DIAGNOSING VEHICLE IN END-OF-LINE PROCESS

FIG. 2



(57) Abstract: Disclosed is a method of providing fuel to a fuel line when diagnosing a vehicle in an end-of-line process. According to the present disclosure, when receiving a request of a diagnostic for a fuel supply unit from a diagnostic apparatus during an end-of-line process, an electronic control unit (ECU) forcibly operates the fuel pump by the predetermined operation times for a predetermined time of the operation at a point of time of diagnosing an operation of the fuel pump, so as to diagnose whether the fuel pump operates and to fill the fuel line extending between a fuel tank and combustion chambers of an engine with fuel in the fuel tank, thereby essentially reducing a time for starting the engine after diagnosing the fuel pump, preventing a reduction of the performance of a starting motor and a battery for a start of the engine, and preventing a decrease of a non-adjusted ratio and a deterioration of the start ability of an engine.

METHOD OF PROVIDING FUEL TO FUEL LINE WHEN DIAGNOSING VEHICLE
IN END-OF-LINE PROCESS

5

Technical Field

The present disclosure relates to a method of providing fuel to a fuel line when diagnosing a vehicle in the end-of-line process. More particularly, the present disclosure relates to a method of providing fuel to a fuel line when diagnosing a vehicle in the end-of-line process, in which a fuel pump is forcibly operated to provide fuel to a fuel line extending between a fuel tank and combustion chambers of an engine, in order to diagnose whether the fuel pump operates, during the end-of-line process.

15

Background Art

Typically, the final step in processes of manufacturing a vehicle is to perform the end-of-line process of diagnosing whether a manufactured vehicle functions normally.

20

In the end-of-line process, it is carried out to examine the normality or the abnormality of each function of a vehicle to be examined. The examination for the functions includes diagnostic for an operation of a fuel pump.

25

With the diagnostic for the normal operation of the fuel pump, when a diagnostic apparatus requests an Electronic Control Unit (ECU), i.e an engine control unit, to diagnose whether the fuel pump normally operates, the ECU repeatedly operates the fuel pump at a designated period in order to determine whether the fuel pump normally operates, in response to the request of the diagnostic apparatus.

30

35

According to the conventional art, generally, a fuel line of the manufactured vehicle on a manufacturing line is filled with fuel after performing the diagnostic. At this time, a starting motor

must be continuously operated by using an ignition key for a designated time, so as to fill the fuel line with the fuel.

5 However, when the fuel line is filled with the fuel in such a manner as the conventional art, there are problems in that the performance of the starting motor as well as a battery decreases, and that a non-adjusted ratio of a process is reduced due to an operation time of the engine.

10 Disclosure

Technical Problem

15 Therefore, the present disclosure has been made in order to solve the above-mentioned problems, and an aspect of the present disclosure is to provide a method of providing fuel to a fuel line when diagnosing a vehicle in the end-of-line process, in which when receiving a request of a diagnostic for a normal operation of a fuel pump from a diagnostic apparatus during an end-of-line process, an electronic control unit (ECU) forcibly operates the fuel pump by the predetermined operation times for a
20 predetermined time of the operation at a point of time of diagnosing an operation of the fuel pump, so as to fill the fuel line extending between a fuel tank and combustion chambers of an engine with fuel in the fuel tank, thereby essentially reducing
25 time for starting the engine after diagnosing the fuel pump.

Technical solution

30 In accordance with an aspect of the present disclosure, a method of providing fuel to a fuel line when diagnosing a vehicle in an end-of-line process is provided. The method includes: starting a diagnostic of whether a fuel pump operates when an electronic control unit receives a signal requesting the diagnostic whether the fuel pump operates during a diagnostic process for the vehicle
35 in the end-of-line process; and performing the diagnostic for the vehicle while a forcibly operating the fuel pump by predetermined operation times of the fuel pump for a predetermined time to turn on/off the fuel pump, and providing the fuel line extending

between a fuel tank and combustion chambers of an engine with the fuel of the fuel tank.

Preferably, the operation times of the fuel pump and the time to
5 turn on/off the fuel pump are set up on a basis of at least one
of a battery voltage of the vehicle at the end-of-line process,
at least one of a length and a diameter of the fuel line, and a
capacity of the fuel pump.

10 Advantageous Effects

Accordingly, in the present disclosure, when receiving a request
of a diagnostic for a fuel supply unit from a diagnostic apparatus
during an end-of-line process, an electronic control unit (ECU)
15 forcibly operates the fuel pump by the predetermined operation
times for a predetermined time of the operation at a point of time
of diagnosing an operation of the fuel pump, so as to diagnose
whether the fuel pump operates and to fill the fuel line extending
between a fuel tank and combustion chambers of an engine with fuel
20 in the fuel tank, thereby essentially reducing time for starting
the engine after diagnosing the fuel pump, preventing a reduction
of the performance of a start motor and a battery for a start of
the engine, and preventing a decrease of a non-adjusted ratio and
a deterioration of the start ability of an engine.

25

Brief Description of the Drawings

The foregoing and other objects, features and advantages of the
present invention will become more apparent from the following
30 detailed description when taken in conjunction with the
accompanying drawings in which:

FIG. 1 is a block diagram illustrating an example of a fuel supply
system including a fuel line, which is connected to a diagnostic
35 apparatus for a manufactured vehicle according to an embodiment
of the present disclosure;

FIG. 2 is a flowchart illustrating a fuel supply process during

a diagnostic of vehicle in an end-of-line process according to the embodiment of the present disclosure; and

FIG. 3 is a view illustrating an operation signal of a fuel pump shown in FIG. 1.

Best Mode

Mode for Invention

Hereinafter, a preferred embodiment of a fuel supply system including a fuel line during a diagnostic for a manufactured vehicle according to the present disclosure will be described in detail with reference to the accompanying drawings.

FIG. 1 is a block diagram illustrating an example of a fuel supply system including a fuel line, which is connected to a diagnostic apparatus for a manufactured vehicle in an end-of-line process according to an embodiment of the present disclosure. As shown in FIG. 1 as an example, the fuel supply system includes a diagnostic apparatus 100 for transmitting a signal requesting a diagnostic for a fuel supply unit including a fuel pump 400 during an execution of a diagnostic mode for a vehicle in an end-of-line process, an electronic control unit 200 for forcibly operating the fuel pump 400 in a vehicle diagnostic process at the end-of-line process, in response to the signal requesting the diagnostic from the diagnostic apparatus 100, and the fuel pump 400 for supplying a fuel line with fuel stored in a fuel tank 300, which is forcibly operated according to the request of the electronic control unit 200.

Here, the diagnostic apparatus 100 may provide the electronic control unit 200 with diagnostic condition information so as for the electronic control unit 200 to execute a diagnostic mode for a manufacturing line at the end-of-line process.

When the diagnostic apparatus 100 is configured to transmit the signal requesting the diagnostic for the fuel supply unit

including the fuel pump 400 to the electronic control unit 200, it is possible that the diagnostic requesting signal includes the diagnostic condition information which is diagnostic information for the fuel supply unit including the fuel pump 400.

5

In a case of receiving the signal requesting a diagnostic of whether the fuel pump 400 operates, from the diagnostic apparatus 100, the electronic control unit 200 is configured to transmit a predetermined signal of operating the fuel pump to the fuel pump 400 at a point of time when the diagnostic for the fuel pump 400 starts. Here, the signal of operating the fuel pump 400 includes the predetermined operation times of the fuel pump and the predetermined operation time of turning on/off the fuel pump, as shown in FIG. 3.

15

As a result of executing the forcible operation of the fuel pump 400, the fuel in the fuel tank 300 is provided to the fuel line extending between the fuel tank 300 and combustion chambers of the engine.

20

Then, when the engine starts after the diagnostic of whether the fuel pump 400 operates, the fuel filled within the fuel line is immediately provided to the combustion chambers of the engine as soon as the engine starts. Accordingly, it is unnecessary to additionally operate the start motor, and also a starting delay can be prevented.

Here, an amount of fuel provided to the fuel line by the forcible operation of the fuel pump 400 can be regulated by previously determining the operation times of the fuel pump and time of the operation of the fuel pump according to the kind of vehicles.

The amount of the fuel filled within the fuel line of the vehicle is previously determined. Accordingly, the operation times of the fuel pump and time of operating the fuel pump can be previously set up. That is, the amount of the fuel to be provided to the fuel line can be regulated by the forcible operation of the fuel pump 400.

35

However, when the forcible operation of the fuel pump 400 is stopped in a state in which the predetermined operation times of the fuel pump and time of operating the fuel pump 400 does not
5 lapse, the predetermined amount of the fuel is insufficiently provided to the fuel line extending to the fuel tank 300 and the combustion chambers of the engine.

That is, the electronic control unit 200 determines that the
10 supply of the fuel to the corresponding fuel line is completed when the operation of the fuel pump 400 is stopped because the operation times of the fuel pump and time of operating the fuel pump is lapsed. However, the electronic control unit 200 may determine that the diagnostic is finished in a state that the
15 supply of the fuel to the fuel line is insufficient, when the diagnostic for the fuel pump 400 is finished during the operation of the fuel pump 400.

At this time, the electronic control unit 200 preferably operates
20 the fuel pump 400 by the operation times of the fuel pump and for time of operating the fuel pump at a point of time when the diagnostic of whether the fuel pump 400 operates is finished.

Further, the operation times of the fuel pump and time of
25 operating the fuel pump can be set up on the basis of at least one of a voltage of a battery, at least one of a length and diameter of the fuel line, and a capacity of the fuel pump 400 in the vehicle at the end-of-line process.

FIG. 2 is a flowchart illustrating a fuel supplying process during
30 a diagnostic of vehicle in an end-of-line process shown in FIG. 1. As shown in FIG. 2 as an example, in a method of providing the fuel to the fuel line when the vehicle is diagnosed at the end-of-line process, when the electronic control unit 200
35 receives the signal requesting the diagnostic for whether the fuel pump 400 operates from the diagnostic apparatus 100, the diagnostic of whether the fuel pump 400 operates starts (S1 and S3).

When the diagnostic of whether the fuel pump 400 operates starts, the electronic control unit 200 forcibly operates the fuel pump 400 while diagnosing whether the fuel pump 400 operates, and is
5 converted into a mode of performing the supply of the fuel to the fuel line (S5).

At this time, the electronic control unit transmits the operating signal shown in FIG. 3 to the fuel pump 400.

10 Here, the operating signal increases a time of turning the fuel pump on/off, and the operation times of the fuel pump at a point of time when the fuel pump turns on/off. Further, when the operation times of the fuel pump arrives at predetermined times,
15 the diagnostic of the fuel pump is stopped.

In the embodiment of the present disclosure, time of turning on the fuel pump and time of turning off the fuel pump are respectively set up. Then, when the time of turning on/off the
20 fuel pump arrives at 0, the fuel pump is converted from on to off, or from off to on. The forcible operation of the fuel pump is stopped when the operation times of the fuel pump arrives at 0 from the predetermined times.

25 At this time, the electronic control unit 200 may determine whether the current operation times of the fuel pump is within the predetermined operation times of the fuel pump at a point of time when a second forcible operation of the fuel pump, except for a case where the fuel pump 400 is turned on/off at a point
30 of time when the electronic control unit 200 is converted into a mode of determining whether the fuel pump operates.

In step S7, when the predetermined operation times arrive at 0, the electronic control unit 200 determines that the forcible
35 operation of the fuel pump 400 is finished, and then stops the execution of the process.

On the contrary, in step S7, when the predetermined operation

times of the fuel pump do not arrive at 0, the electronic control unit 200 determines that the forcible operation of the fuel pump 400 is not finished, and reduces and count the operation times of the fuel pump by 1 time. Then, the electronic control unit
5 200 continues to forcibly operate the fuel pump 400 (S9 and S11).

In step S11, when the fuel pump 400 is forcibly and continuously operated, the fuel pump 400 is forcibly turned on/off at predetermined periods for time of turning on/off the fuel pump.
10

That is, the fuel pump 400 is operated to supply the corresponding fuel from the fuel tank 300 to the fuel line for a time to turn on the fuel pump 400 during the operation of the fuel pump at a first period, and then the fuel pump 400 stops its operation for
15 a predetermined time to turn off the fuel pump 400 when the time to turn on the fuel pump 400 finishes at 0. On the other hand, when the time to turn off the fuel pump 400 finishes at 0, the operation time of the fuel pump is reduced and then the fuel pump is operated at a second period.

20 When the above-mentioned time to turn on/off the fuel pump at the first period lapses, it proceeds to step S7 again and it is determined whether the forcible operation of the fuel pump 400 will be continuously performed (S13).

25
Industrial Applicability

When the electronic control unit receives a signal requesting a diagnostic for the fuel supply unit from the diagnostic apparatus
30 during the diagnostic for a vehicle, the fuel pump is forcibly operated by the predetermined operation times of the fuel pump for a time to turn on/off the fuel pump, so as to diagnose whether the fuel pump normally operates and to fill the fuel line extending between the fuel tank and the combustion chambers of
35 the engine with the fuel of the fuel tank. Thereby, it is possible to remove a process of filling the fuel line with fuel at a point of time to start the engine after the diagnostic for the fuel pump. Also, in the end-of-line process capable of preventing the

reduction of the non-adjusted ratio and the deterioration of the start ability of the engine which have been caused by the conventional engine starting process, the present disclosure will make progress in a precision and a reliability of the application of the fuel supplying method and in the efficiency and the performance during the diagnostic for a vehicle. The present disclosure has an industrial applicability since it can be carried out currently and definitely, also vehicles to which the present disclosure is applied can be placed on sale, and an effectiveness of business is improved.

Although several exemplary embodiments of the present disclosure have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Patent claims

1. A method of providing fuel to a fuel line when diagnosing a vehicle in an end-of-line process, the method comprising:
5 starting a diagnostic of whether a fuel pump operates when an electronic control unit receives a signal requesting the diagnostic whether the fuel pump operates during a diagnostic process for the vehicle in the end-of-line process; and
10 performing the diagnostic for the vehicle while a forcibly operating the fuel pump by predetermined operation times of the fuel pump for a predetermined time to turn on/off the fuel pump, and providing the fuel line extending between a fuel tank and combustion chambers of an engine with the fuel
15 of the fuel tank.
2. The method as claimed in claim 1, wherein the operation times of the fuel pump and the time to turn on/off the fuel pump are set up on a basis of at least one of a battery voltage
20 of the vehicle at the end-of-line process, at least one of a length and a diameter of the fuel line, and a capacity of the fuel pump.

FIG. 1

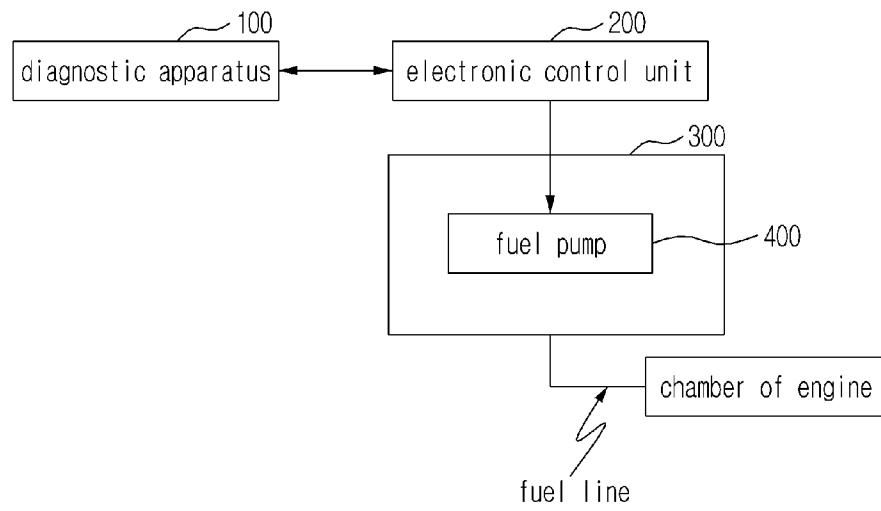


FIG. 2

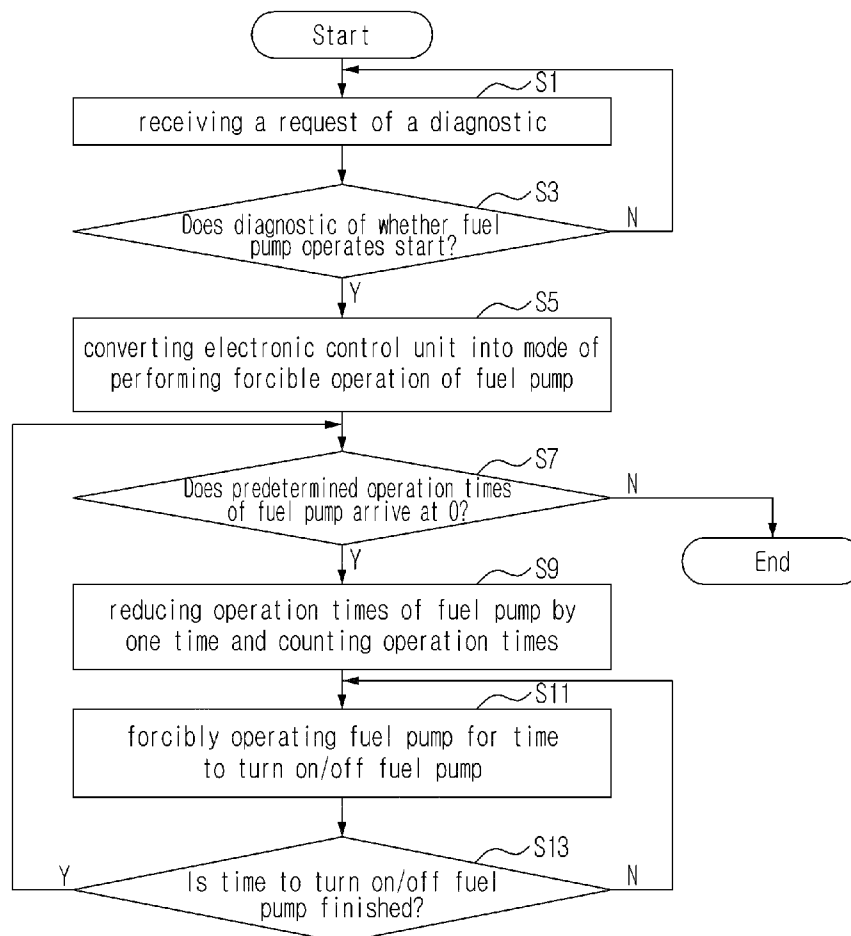
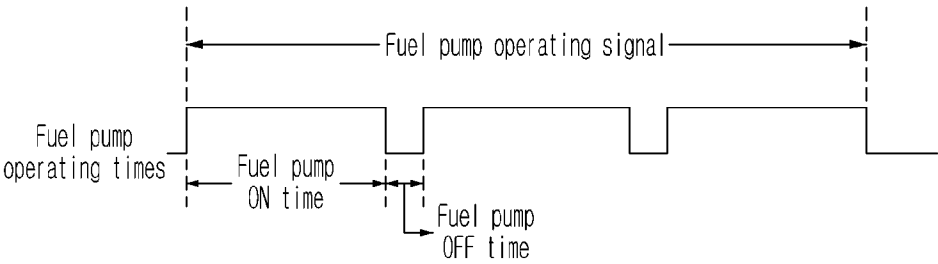


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. F02D41/22 F02M37/04 F02M37/10 G01M15/04
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F02D F02M G01M

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

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

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/112126 A1 (HOSOYA HAJIME [JP]) 17 June 2004 (2004-06-17) paragraphs [0008] - [0011] claim 1 figures 1,2	1,2
X	----- WO 01/83971 A1 (BOSCH GMBH ROBERT [DE]; SCHILLING STEPHAN [DE]; DEHMEL WOLFGANG [DE];) 8 November 2001 (2001-11-08) the whole document	1,2
A	----- US 2008/009987 A1 (WILLIAMS EDWARD T [GB] ET AL WILLIAMS EDWARD [GB] ET AL) 10 January 2008 (2008-01-10) the whole document	1,2
A	----- DE 10 2009 048517 A1 (FORD GLOBAL TECH LLC [US]) 6 May 2010 (2010-05-06) the whole document	1,2

☐

Further documents are listed in the continuation of Box C.

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See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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