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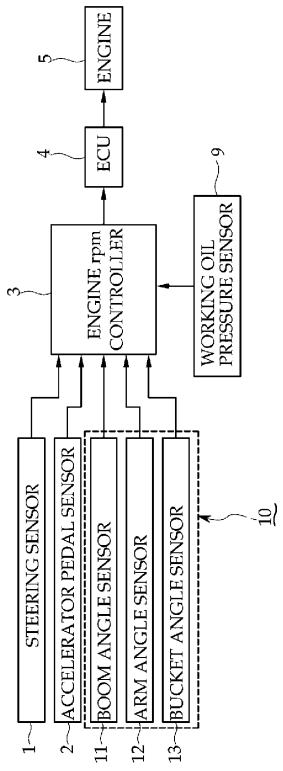
(54) **LOW IDLE CONTROL SYSTEM OF CONSTRUCTION EQUIPMENT AND AUTOMATIC CONTROL METHOD THEREOF**

(57) The present invention discloses a low idle control system of construction equipment and an automatic control method thereof. The low idle control system of construction equipment includes: a front angle change sensing means which detects an operation of at least a part of a front unit through changes in an angle; a controller which is electrically connected to the front angle change sensing means, determines whether to enter an auto idle state by receiving an output signal that is transmitted from the front angle change sensing means, and generates an rpm control signal corresponding to the result of the determination on whether to enter the auto idle state; and an ECU which controls the rpm of an engine by receiving the rpm control signal outputted from the controller. The present invention is capable of implementing an effective auto idle function by more accurately recognizing a state of using equipment.

Fig.1



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Description

[Technical Field]

[0001] The present invention relates to a low idle control system of construction equipment and an automatic control method thereof, and more particularly, to a low idle control system of construction equipment and an automatic control method thereof, capable of implementing an effective auto idle function by accurately recognizing a state of using equipment.

[Background Art]

[0002] In general, there are excavators, wheel loaders, and the like as construction equipment. The excavators perform various operations such as operations of excavating, leveling the ground, compacting the ground, lifting heavy objects, and the like. The excavator has a working device including a boom, an arm, and a bucket, and work of the excavator is performed by controlling the working device including the boom, the arm, and the bucket by operating each corresponding actuator (or a hydraulic cylinder). The wheel loader refers to equipment that is used to perform civil work at construction sites, and is widely used to perform operations of conveying powder materials such as soil, sand, or the like, loading or unloading conveyed soil and sand onto or from freight vehicles, leveling ground for road, removing snow, towing vehicles, and the like.

[0003] In the construction equipment such as the excavator, the wheel loader, or the like according to the related art, a technology of converting a state of an engine into an idle state so as to improve fuel efficiency is generally applied in a case in which pressure of working oil in an accelerator pedal, a steering part, and a front unit is not varied for a predetermined time. This function is typically referred to as an 'auto idle function'.

[0004] In the construction equipment of the related art, a no-load operation, for example, a bucket dump, a boom floating that the boom is lowered by its own weight, or the like, may occur during performing work. However, because a variation in pressure of the front unit is very small when the no-load operations are performed, it may be recognized that the equipment does not work. Accordingly, a case occurs in which the equipment enters the aforementioned auto idle state, or the auto idle state, which is already in progress, is continued. However, the aforementioned no-load operation is frequently converted directly into a load operation, and in this case, because the auto idle state needs to be suddenly released, there is a problem in that the engine is stopped (engine stall), or an increase in output of the engine is delayed.

[Disclosure]

[Technical Problem]

[0005] The present invention has been made in an effort to solve the aforementioned problem, and an object of the present invention is to provide a low idle control system of construction equipment and an automatic control method thereof, capable of implementing an effective auto idle function by more accurately recognizing a state of using equipment.

[Technical Solution]

[0006] In order to achieve the aforementioned object, the present invention provides a low idle control system of construction equipment, including: a front angle change sensing means which detects an operation of at least a part of a front unit through changes in an angle; a controller which is electrically connected to the front angle change sensing means, determines whether to enter an auto idle state by receiving an output signal that is transmitted from the front angle change sensing means, and generates an rpm control signal corresponding to the result of the determination on whether to enter the auto idle state; and an ECU which controls the rpm of an engine by receiving the rpm control signal outputted from the controller.

[0007] In addition, with respect to the above exemplary embodiment of the present invention, the present invention further provides the following specific exemplary embodiments.

[0008] According to the exemplary embodiment of the present invention, the front angle change sensing means may include at least one of a boom angle sensor which is installed at an upper turning unit and detects a change in an angle of a boom, an arm angle sensor which is installed at the boom and detects a change in an angle of an arm, and a bucket angle sensor which is installed at the arm and detects a change in an angle of a bucket.

[0009] According to the exemplary embodiment of the present invention, the low idle control system of construction equipment may further include: an accelerator pedal sensor which detects operating pressure of an accelerator pedal or a change in angle of the accelerator pedal; and a steering sensor which detects a change in angle or operating pressure of a steering wheel or a steering joystick, in which the controller may additionally consider signals outputted from the accelerator pedal sensor and the steering sensor, at the time of determining whether to enter the auto idle state.

[0010] According to the exemplary embodiment of the present invention, the low idle control system of construction equipment may further include: a working oil pressure sensor which detects pilot pressure that is generated corresponding to pressure of working oil supplied to drive a working device of the front unit, or an operation of an operating lever for operating the front unit, in which

the controller may additionally consider a signal outputted from the working oil pressure sensor, at the time of determining whether to enter the auto idle state.

[0011] Meanwhile, as another exemplary embodiment, the present invention provides an automatic control method of a low idle control system of construction equipment, including: monitoring output signals that are received from a steering sensor, an accelerator pedal sensor, and a front angle change sensing means (S20) ; determining whether a preset output signal corresponding to a steering pressure reference value or less from the steering sensor, an off signal from the accelerator pedal sensor, and an off signal from the front angle change sensing means are continued for a predetermined time or more (S22) ; entering an auto idle mode by recognizing that the equipment does not work when it is determined that the condition is continued for a predetermined time or more according to the determination result of step S22 (S24) ; and outputting normal rpm by inputting a preset control signal into the ECU, which controls the engine, when it is determined that the condition is not satisfied according to the determination result of step S22 (S22a) .

[0012] In addition, with respect to the above exemplary embodiment of the present invention, the present invention further provides the following specific exemplary embodiments.

[0013] According to the exemplary embodiment of the present invention, the automatic control method of a low idle control system of construction equipment may further include: determining, after step S24, whether at least one of a preset output signal corresponding to a steering pressure reference value or more from the steering sensor, an operating signal from the accelerator pedal sensor, and an operating signal from the front angle change sensing means is received (S26), in which when it is determined that at least a signal of the signals is received according to the determination result, a preset control signal is inputted into the ECU, which controls the engine, and normal rpm is outputted (S22a).

[Effects]

[0014] The present invention additionally provides an angle change sensing means, which may detect an operation of a front unit through changes of the angle of the front unit, in addition to the existing partial input elements (a steering sensor and an accelerator pedal sensor) that are used to determine a state of using equipment, and an ECU may be controlled by a controller using signals of the aforementioned components, thereby implementing an effective auto idle function by more accurately recognizing a state of using the equipment.

[Description of Drawings]

[0015]

FIG. 1 is a schematic block diagram illustrating the entire configuration of a low idle control system of construction equipment according to the present invention.

FIG. 2 is a control flow chart for explaining an automatic control method of a low idle control system of construction equipment according to the present invention.

[Description of Main Reference Numerals of Drawings]

[0016]

1: Steering sensor
2: Accelerator pedal sensor
3: Controller
4: ECU
5: Engine
10: Front angle change sensing means
11: Boom angle sensor
12: Arm angle sensor
13: Bucket angle sensor

[Detailed Description of Certain Inventive Embodiments]

[0017] Hereinafter, an exemplary embodiment of an automatic control method of a low idle control system of construction equipment according to the present invention will be described with reference to FIGS. 1 and 2.

[0018] As illustrated in FIG. 1, a low idle control system of construction equipment according to a preferred exemplary embodiment of the present invention includes a front angle change sensing means 10, a controller 3, and an ECU 4.

[0019] The front angle change sensing means 10 detects an operation of at least a part of a front unit (for example, a working device) through changes in an angle. The controller 3 is electrically connected to the front angle change sensing means 10. The controller 3 determines whether to enter an auto idle state by receiving an output signal that is transmitted from the front angle change sensing means 10, and generates an rpm control signal corresponding to the result of the determination on whether to enter the auto idle state. The ECU 4 controls the rpm of an engine 5 by receiving the rpm control signal outputted from the controller 3.

[0020] In addition, as illustrated in FIG. 1, a low idle control system of construction equipment according to another preferred exemplary embodiment of the present invention further includes a steering sensor 1, and an accelerator pedal sensor 2. The steering sensor 1 detects an operation of a steering wheel or a steering joystick through changes in pressure or an angle, and the accelerator pedal sensor 2 detects an operation of an accelerator pedal through changes in pressure or an angle.

[0021] In addition, a working oil pressure sensor 9,

which measures pilot pressure that is generated corresponding to pressure of working oil supplied to drive a drive unit of the existing steering device and the existing front working device, or an operation of an operating lever, may be used. In this case, the controller 3 first confirms whether to enter an auto idle mode on the basis of an inputted signal from the working oil pressure sensor 9, and then may determine whether to enter/release the auto idle mode according to the detection result of the front angle change sensing means 10. In this case, the problem of the related art may be solved only by additionally installing the front angle change sensing means 10, which may be comparatively easily installed in the front working device, in the existing equipment, and correcting a control method as described above.

[0022] The controller 3 is electrically connected to the steering sensor 1 and the accelerator pedal sensor 2, or the working oil pressure sensor 9, respectively. Accordingly, the controller 3 may additionally consider signals outputted from the accelerator pedal sensor 2 and the steering sensor 1, or a signal outputted from the working oil pressure sensor 9, at the time of determining whether to enter the auto idle mode.

[0023] Moreover, the ECU 4 may control the rpm of the engine 5 by receiving the rpm control signal corresponding to output signals from the steering sensor 1, the accelerator pedal sensor 2, and the front angle change sensing means 10 in the controller 3.

[0024] Meanwhile, the front angle change sensing means 10 may be configured by at least one of a boom angle sensor 11 which is installed at an upper turning unit and detects a change in an angle of a boom, an arm angle sensor 12 which is installed at the boom and detects a change in an angle of an arm, and a bucket angle sensor 13 which is installed at the arm and detects a change in an angle of a bucket.

[0025] Even though the front angle change sensing means 10 is individually used, the front angle change sensing means 10 may implement a function of entering/releasing the auto idle state corresponding to most operations except for traveling/turning operations.

[0026] In order to add a function for a more accurate control of entering/releasing the auto idle state and various items of convenience, all of the steering sensor 1, the accelerator pedal sensor 2, the working oil pressure sensor 9, and the front angle change sensing means 10, which are described above, may be installed.

[0027] An automatic control method of the low idle control system of construction equipment according to the present invention, which is based on the aforementioned hardware configuration, will be described with reference to a control flow chart of FIG. 2.

[0028] First, in a state in which the construction equipment is started, and then the engine is driven, the controller 3 monitors output signals that are received from the steering sensor 1, the accelerator pedal sensor 2, and the front angle change sensing means 10 (S20) .

[0029] Next, it is determined whether a preset output signal corresponding to a steering pressure reference value or less from the steering sensor 1, an off signal from the accelerator pedal sensor 2, and an off signal from the front angle change sensing means 10 are continued for a predetermined time or more (S22) .

[0030] Here, when it is determined that the aforementioned condition is continued for a predetermined time (for example, 5 seconds) or more according to the determination result of step S22, it is recognized that the equipment does not work, and then the equipment enters the auto idle mode (S24) .

[0031] Alternatively, when it is determined that the aforementioned condition is not satisfied according to the determination result of step S22, a preset control signal is inputted into the ECU 4, which controls the engine 5, and normal rpm is outputted (S22a) .

[0032] Next, after step S24, it is determined whether at least one of a preset output signal corresponding to a steering pressure reference value or more from the steering sensor 1, an operating signal from the accelerator pedal sensor 2, and an operating signal from the front angle change sensing means 10 is received (S26) .

[0033] When it is determined that at least a signal of the aforementioned signals is received according to the determination result of step S26, a preset control signal is inputted into the ECU 4, which controls the engine 5, and normal rpm is outputted (S22a).

[0034] The present invention described above is not limited to the aforementioned exemplary embodiment and the accompanying drawings, and it is apparent to those persons skilled in the art that simple substitutions, modifications and alterations may be made without departing from the technical spirit of the present invention.

[Industrial Applicability]

[0035] The present invention additionally provides an angle change sensing means, which may detect an operation of a front unit through changes in the angle of the front unit, in addition to the existing partial input elements (a steering sensor, an accelerator pedal sensor, and a working oil pressure sensor) that are used to determine a state of using equipment, and an ECU may be controlled by a controller using signals of the aforementioned components, thereby implementing an effective auto idle function by more accurately recognizing a state of using the equipment.

Claims

1. A low idle control system of construction equipment, comprising:

   a front angle change sensing means 10 which detects an operation of at least a part of a front unit through changes in an angle;
   a controller 3 which is electrically connected to

the front angle change sensing means 10, determines whether to enter an auto idle state by receiving an output signal that is transmitted from the front angle change sensing means 10, and generates an rpm control signal corresponding to the result of the determination on whether to enter the auto idle state; and
an ECU 4 which controls the rpm of an engine 5 by receiving the rpm control signal outputted from the controller 3.

2. The low idle control system of construction equipment of claim 1, wherein the front angle change sensing means 10 includes at least one of a boom angle sensor 11 which is installed at an upper turning unit and detects a change in an angle of a boom, an arm angle sensor 12 which is installed at the boom and detects a change in an angle of an arm, and a bucket angle sensor 13 which is installed at the arm and detects a change in an angle of a bucket.

3. The low idle control system of construction equipment of claim 1, further comprising:

an accelerator pedal sensor 2 which detects operating pressure of an accelerator pedal or a change in an angle of the accelerator pedal; and
a steering sensor 1 which detects a change in an angle or operating pressure of a steering wheel or a steering joystick,
wherein the controller 3 additionally considers signals outputted from the accelerator pedal sensor 2 and the steering sensor 1, at the time of determining whether to enter the auto idle state.

4. The low idle control system of construction equipment of claim 1, further comprising:

a working oil pressure sensor 9 which detects pilot pressure that is generated corresponding to pressure of working oil supplied to drive a working device of the front unit, or an operation of an operating lever for operating the front unit,
wherein the controller 3 additionally considers a signal outputted from the working oil pressure sensor 9, at the time of determining whether to enter the auto idle state.

5. An automatic control method of a low idle control system of construction equipment, comprising:

monitoring output signals that are received from a steering sensor, an accelerator pedal sensor, and a front angle change sensing means (S20);
determining whether a preset output signal corresponding to a steering pressure reference value or less from the steering sensor, an off signal from the accelerator pedal sensor, and an off signal from the front angle change sensing means are continued for a predetermined time or more (S22);
entering an auto idle mode by recognizing that the equipment does not work when it is determined that the condition is continued for a predetermined time or more according to the determination result of step S22 (S24); and
outputting normal rpm by inputting a preset control signal into the ECU, which controls the engine, when it is determined that the condition is not satisfied according to the determination result of step S22 (S22a).

6. The automatic control method of a low idle control system of construction equipment of claim 5, further comprising:

determining, after step S24, whether at least one of a preset output signal corresponding to a steering pressure reference value or more from the steering sensor, an operating signal from the accelerator pedal sensor, and an operating signal from the front angle change sensing means is received (S26),
wherein when it is determined that at least a signal of the signals is received according to the determination result, a preset control signal is inputted into the ECU, which controls the engine, and normal rpm is outputted (S22a).

Fig.1

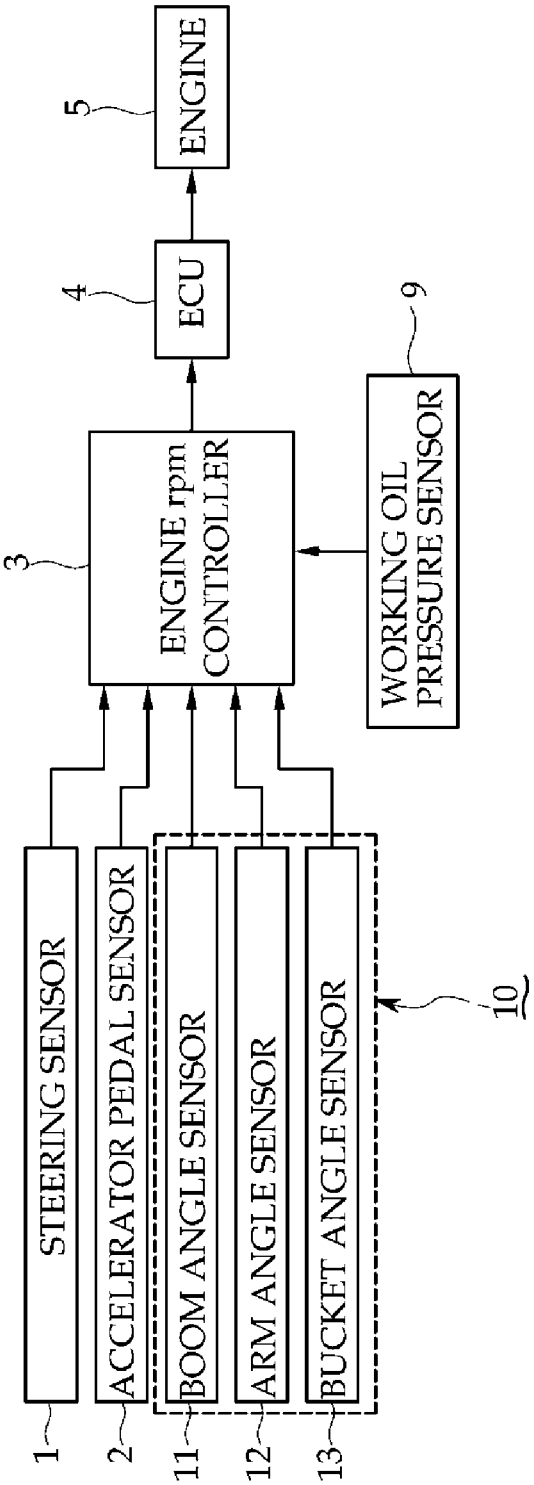
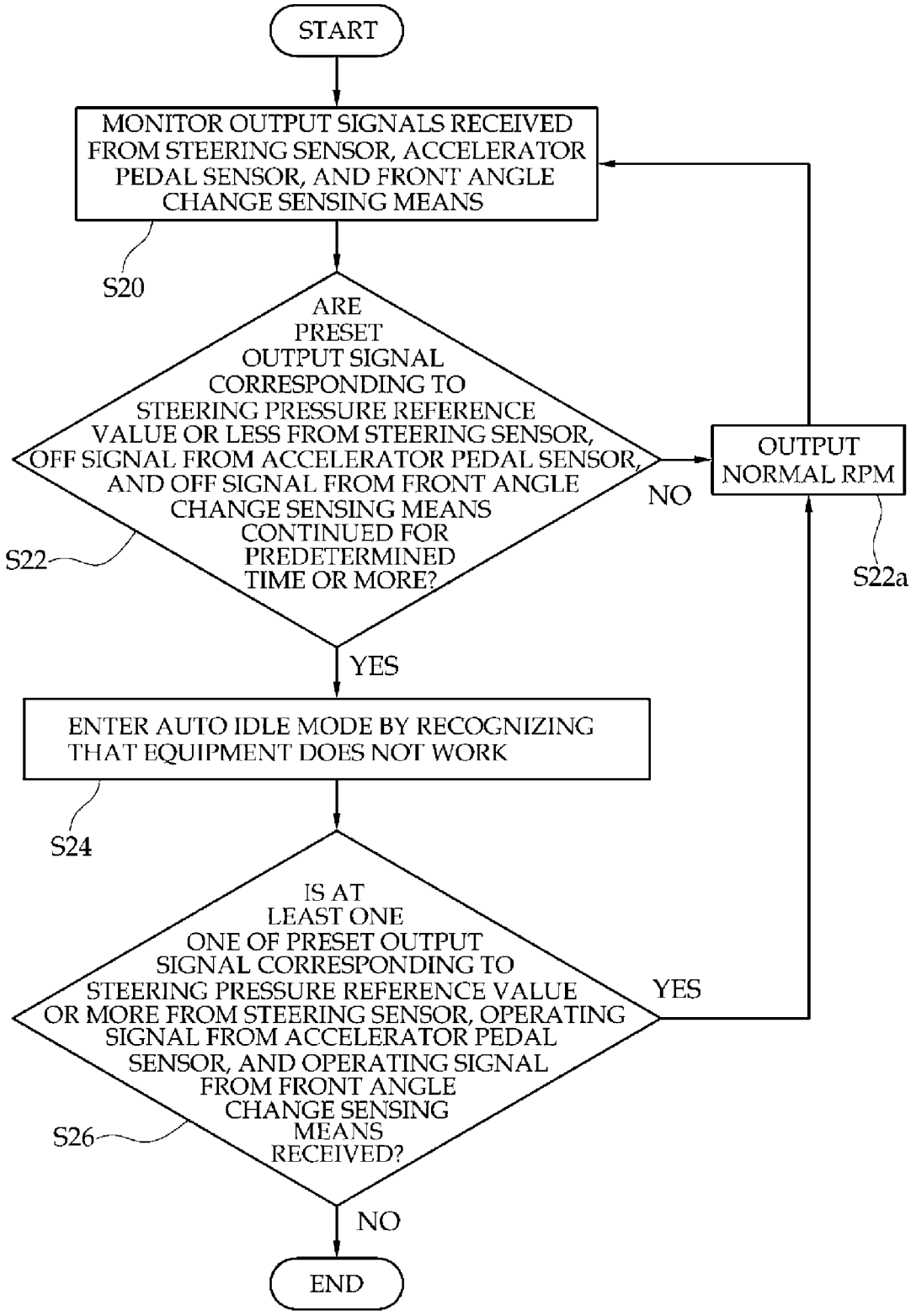

5
ENGINE
4
ECU
9
3
ENGINE rpm CONTROLLER
WORKING OIL PRESSURE SENSOR
STEERING SENSOR
ACCELERATOR PEDAL SENSOR
BOOM ANGLE SENSOR
ARM ANGLE SENSOR
BUCKET ANGLE SENSOR
10
1
2
11
12
13

Fig.2


START
MONITOR OUTPUT SIGNALS RECEIVED FROM STEERING SENSOR, ACCELERATOR PEDAL SENSOR, AND FRONT ANGLE CHANGE SENSING MEANS
S20
ARE PRESET OUTPUT SIGNAL CORRESPONDING TO STEERING PRESSURE REFERENCE VALUE OR LESS FROM STEERING SENSOR, OFF SIGNAL FROM ACCELERATOR PEDAL SENSOR, AND OFF SIGNAL FROM FRONT ANGLE CHANGE SENSING MEANS CONTINUED FOR PREDETERMINED TIME OR MORE?
S22
NO
OUTPUT NORMAL RPM
S22a
YES
ENTER AUTO IDLE MODE BY RECOGNIZING THAT EQUIPMENT DOES NOT WORK
S24
IS AT LEAST ONE ONE OF PRESET OUTPUT SIGNAL CORRESPONDING TO STEERING PRESSURE REFERENCE VALUE OR MORE FROM STEERING SENSOR, OPERATING SIGNAL FROM ACCELERATOR PEDAL SENSOR, AND OPERATING SIGNAL FROM FRONT ANGLE CHANGE SENSING MEANS RECEIVED?
S26
YES
NO
END