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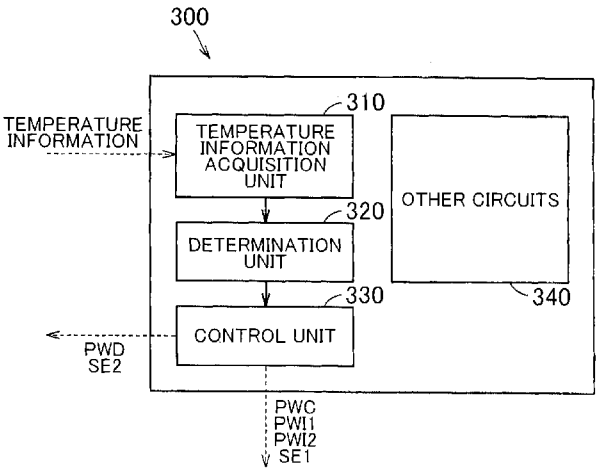
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[Continued on next page]

(54) Title: CONTROL DEVICE AND CONTROL METHOD FOR HYBRID VEHICLE, AND HYBRID VEHICLE

FIG. 3



(57) Abstract: A control device for a hybrid vehicle includes a temperature information acquisition unit 310 which acquires information relating to the temperature of an electric storage device, and a control unit 330 which, when the temperature of the electric storage device is outside a predetermined range, causes an internal combustion engine to drive a rotating electric machine and controls the hybrid vehicle to supply generated power of the rotating electric machine to the outside of the hybrid vehicle without charging the electric storage device, and when the temperature of the electric storage device is within the predetermined range, controls the hybrid vehicle to supply power of the electric storage device to the outside of the hybrid vehicle.

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CONTROL DEVICE AND CONTROL METHOD FOR HYBRID VEHICLE, AND HYBRID VEHICLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a control device and a control method for a hybrid vehicle, and a hybrid vehicle.

2. Description of Related Art

[0002] A hybrid vehicle using an internal combustion engine and a rotating electric machine has been heretofore known. A rotating electric machine and an electric storage device are mounted in the hybrid vehicle. The electric storage device is charged with generated electric power of the rotating electric machine which is driven by the internal combustion engine.

[0003] In recent years, the charging of the electric storage device may be performed by inserting a plug of a charging cable into a power supply provided in a house or the like. Power of the electric storage device may be discharged in a house (for example, see Japanese Patent Application Publication No. 2007-236023 (JP 2007-236023 A). A hybrid vehicle in which power transmission is performed with the house through the charging cable is referred to as "plug-in hybrid vehicle" (for example, see Japanese Patent Application Publication No. 2013-51772 (JP 2013-51772 A)).

[0004] JP 2007-236023 A or JP 2013-51772 A suggests the supply (hereinafter, referred to as "external power feed") of power generated by the rotating electric machine mounted in the hybrid vehicle or power of the electric storage device mounted in the hybrid vehicle to the outside of the hybrid vehicle.

[0005] The magnitude of power which can be extracted from the electric storage device changes depending on the temperature of the electric storage device. For example, if the temperature of the electric storage device is too low, power cannot be extracted from the electric storage device. If the temperature of the electric storage device is too high, for example, deterioration with the use of the electric storage device is likely to be

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advanced. Accordingly, when the temperature of the electric storage device is too low or too high, the magnitude of power which can be extracted from the electric storage device may be limited. However, if the magnitude of power which can be extracted from the electric storage device is limited, external power feed may not be performed smoothly. For this reason, when performing external power feed with power of the electric storage device, it is preferable to take into consideration the temperature of the electric storage device.

SUMMARY OF THE INVENTION

[0006] Therefore, the object underlying the invention is to provide a control device for a hybrid vehicle which enables external power feed, taking into consideration the temperature of the electric storage device.

[0007] A control device according to the invention is used for a hybrid vehicle in which an internal combustion engine, a rotating electric machine, e.g. motor generator, and an electric storage device are mounted, and which is able to perform external power feed. Here, external power feed refers to the supply of power from the hybrid vehicle, i.e. of power from the electric storage device, of power generated by the rotating electric machine, or of combined power combining power from the electric storage device and power generated power by the rotating electric machine, to an external electrical consumer or electric apparatus outside of the hybrid vehicle. "Power" refers to electrical power. The control device includes a temperature information acquisition unit which acquires information relating to the temperature of the electric storage device, and a control unit which, when the temperature of the electric storage device is outside a predetermined range, causes the internal combustion engine to drive the rotating electric machine and controls the hybrid vehicle to supply generated power of the rotating electric machine to the outside of the hybrid vehicle without charging the electric storage device, and when the temperature of the electric storage device is within the predetermined range, controls the hybrid vehicle to supply power of the electric storage device to the outside of the hybrid vehicle.

[0008] With this, for example, it becomes possible to supply power to the outside of the hybrid vehicle without being limited by the characteristics of the electric storage device in a wide temperature range.

[0009] An upper limit temperature of the predetermined range may be a temperature under a condition in which the electric storage device is deteriorated or the output of the electric storage device is limited at a temperature higher than the upper limit temperature, and a lower limit temperature of the predetermined range may be a temperature under a condition in which the output of the electric storage device is limited at a temperature lower than the lower limit temperature.

[0010] Information relating to the temperature of the electric storage device may be an air temperature outside the electric storage device. An air conditioner may be further mounted in the hybrid vehicle, and when the temperature of the electric storage device is lower than a lower limit temperature of the predetermined range, the control device may control the air conditioner to warm the electric storage device. The control device according to the invention may further include a determination unit which receives temperature information from the temperature information acquisition unit and performs a determination about whether or not the temperature of the electric storage device exceeds the predetermined range. The control unit may then control power supply from the hybrid vehicle to the outside of the hybrid vehicle depending from the determination result.

[0011] With the control device according to the invention, it becomes possible to perform external power feed, taking into consideration the temperature of the electric storage device. The present invention relates also to a control method for a hybrid vehicle and a hybrid vehicle as it is indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Features, advantages, and technical and industrial significance of an exemplary embodiment of the invention will be described below with reference to the accompanying drawings, in which like numerals denote like elements, and wherein:

FIG. 1 is an overall block diagram of a hybrid vehicle which is controlled by a control device according to an embodiment of the invention.

FIG. 2 is a diagram illustrating an operation when a vehicle supplies power to an electric apparatus outside the vehicle.

FIG. 3 is a diagram illustrating an example of details of an ECU.

FIG. 4 is a graph illustrating the relationship between chargeable/dischargeable power and a temperature of an electric storage device.

FIG. 5 is a flowchart illustrating control which is executed when power feed from a vehicle to an electric apparatus is performed.

DETAILED DESCRIPTION OF AN EMBODIMENT

[0013] Hereinafter, an embodiment of the invention will be described in detail referring to the drawings. In the drawings, the same or corresponding portions are represented by the same reference numerals, and description thereof will not be repeated.

[0014] FIG. 1 is an overall block diagram of a hybrid vehicle 100 (hereinafter, simply referred to as "vehicle 100") which is controlled by a control device for a hybrid vehicle according to an embodiment of the invention. Referring to FIG. 1, the vehicle 100 includes an electric storage device 110, a system main relay 115 (SMR 115), a power control unit (PCU) 120, motor generators MG1, MG2, a power transmission gear 140, a driving wheel 150, an engine 160 as an internal combustion engine, an electronic control unit (ECU) 300 as a control device, a charging relay 210 (CHR 210), a power conversion device 200, a temperature sensor 800, and an air conditioner 900. The PCU 120 includes a converter 121, inverters 122, 123, and capacitors C1, C2.

[0015] The electric storage device 110 is a power storage element which is configured to perform charging or discharging. The electric storage device 110 includes, for example, a secondary battery, such as a lithium ion battery, a nickel-hydrogen battery, or a lead storage battery, or an electric storage element, such as an electric double layer capacitor. The electric storage device 110 is connected to the PCU 120 through power lines PL1, NL1. A voltage VB and a current IB of the electric storage device 110 are measured by sensors (not shown), and information is transmitted to the ECU 300. The power lines PL1, NL1 and power lines PL2, NL2 are provided in parallel with the electric

storage device 110. When the SMR 115 and the CHR 210 are in an on state, the power lines PL1, NL1 and the power lines PL2, NL2 are electrically conducted and are at the same potential. The power lines PL1, NL1 are power lines which are provided to connect the electric storage device 110 and the converter 121. The power lines PL2, NL2 are power lines which are provided to connect the electric storage device 110 and the power conversion device 200. The electric storage device 110 can be discharged to the power lines PL1, NL1 and the power lines PL2, NL2 or can be charged from these power lines.

[0016] First, the configuration from the electric storage device 110 to the power lines PL1, NL1 side will be described. The system main relay 115 (SMR 115) is provided between the electric storage device 110 and the power lines PL1, NL1. The SMR 115 operates based on a control signal SE1 from the ECU 300. The SMR 115 electrically connects or disconnects the electric storage device 110 and the PCU 120.

[0017] The PCU 120 includes a capacitor C1, the converter 121, a capacitor C2, and inverters 122, 123.

[0018] The converter 121 operates based on a control signal PWC from the ECU 300. The converter 121 performs voltage conversion. The capacitors C1, C2 for smoothing or the like are connected to the converter 121.

[0019] The inverters 122, 123 are connected in parallel with the converter 121. The inverters 122, 123 respectively operate based on control signals PWI1, PWI2 from the ECU 300. The inverters 122, 123 convert DC power supplied from the converter 121 to AC power, and supply AC power to the motor generators MG1, MG2. The inverters 122, 123 may convert generated power (AC power) of the motor generators MG1, MG2 to DC power, and may supply DC power to the converter 121.

[0020] The motor generators MG1, MG2 are AC rotating electric machines. The output torques of the motor generators MG1, MG2 are transmitted to the driving wheel 150 through the power transmission gear 140. The power transmission gear 140 includes a reduction gear or a power division mechanism. During a regenerative braking operation of the vehicle 100, the motor generators MG1, MG2 can generate power by a rotational force of the driving wheel 150. The motor generators MG1, MG2 are coupled

to the engine 160 through the power transmission gear 140. The motor generators MG1, MG2 and the engine 160 operate in cooperation under the control of the ECU 300. With this, it is possible to generate a vehicle driving force as requested. The motor generators MG1, MG2 may generate power by the rotation of the engine 160, as well as during the regenerative braking operation of the vehicle 100.

[0021] In the above-described configuration, the ECU 300 can cause the engine 160 to drive the motor generators MG1, MG2 and can control the vehicle 100 to supply generated power of the motor generators MG1, MG2 to the power lines PL1, NL1.

[0022] Next, the configuration from the electric storage device 110 to the power lines PL2, NL2 side will be described. The CHR 210 is provided between the electric storage device 110 and the power lines PL2, NL2. The CHR 210 operates based on a control signal SE2 from the ECU 300. The CHR 210 electrically connects or disconnects the electric storage device 110 and the power conversion device 200.

[0023] The power conversion device 200 is connected to an inlet 220 through power lines ACL1, ACL2. The power conversion device 200 is controlled by a control signal PWD from the ECU 300. The power conversion device 200 converts power (basically, AC power) from the inlet 220 to DC power, and supplies DC power to the power lines PL2, NL2. The power conversion device 200 may receive DC power from the power lines PL2, NL2, may convert DC power to AC power, and may supply AC power to the power lines ACL1, ACL2. The power conversion device 200 may be a single device in which two-way power conversion of charging and power feed is possible, or may include a device for charging and a device for power feed as separate devices.

[0024] In the example shown in FIG. 1, a charging connector 410 of a charging cable 400 is connected to the inlet 220. With this, power from an external power supply 500 outside the vehicle 100 is provided to the inlet 220. The charging cable 400 includes, in addition to the charging connector 410, a plug 420 which is provided for connection to a socket 510 of the external power supply 500, and a power line 440 which connects the charging connector 410 and the plug 420. A charging circuit interrupt device (CCID) 430 which is provided to switch between power supply and shutoff from the external power

supply 500 is inserted into the power line 440.

[0025] In the above-described configuration, the ECU 300 can control the vehicle 100 to supply power of the power lines PL2, NL2 to the outside of the vehicle 100.

[0026] The ECU 300 includes a central processing unit (CPU), a storage device, and an input/output buffer (all of these are not shown). The ECU 300 performs input of signals from sensors or the like or output of control signals to devices, and performs control of the electric storage device 110 and the devices of the vehicle 100. The control may be realized by dedicated hardware (electronic circuit or the like) or may be realized by software. The ECU 300 calculates the residual capacity (state of charge (SOC)) of the electric storage device 110 based on the detection values of the voltage VB and the current IB from the electric storage device 110. The ECU 300 receives a proximity detection signal PISW indicating the connection state of the charging cable 400 from the charging connector 410. The ECU 300 receives a control pilot signal CPLT from the CCID 430 of the charging cable 400. The ECU 300 executes a charging operation based on these signals. The signal PISW indicating the connection state or the pilot signal CPLT is standardized in the Society of Automotive Engineers (SAE) in the U.S., Japan Electric Vehicle Association, or the like.

[0027] The temperature sensor 800 measures (or detects) the temperature of the vehicle 100. Specifically, the temperature sensor 800 measures the temperature of the electric storage device 110 or the ambient temperature (hereinafter, also referred to as "outside air temperature") of the electric storage device 110. For example, when the electric storage device 110 is disposed in a vehicle interior, a luggage room communicating with the vehicle interior, or the like, the temperature sensor 800 may measure the temperature of the vehicle interior. The measurement value of the temperature sensor 800 is transmitted to the ECU 300. With this, the ECU 300 can acquire information relating to the temperature of the electric storage device 110.

[0028] The air conditioner 900 adjusts the temperature of the vehicle 100. The air conditioner 900 operates using generated power of the motor generator MG1 by the driving of the engine 160 or power of the electric storage device 110. The air conditioner

900 is controlled by the ECU 300. With this, the ECU 300 can adjust the temperature of the vehicle 100.

[0029] As described above referring to FIG. 1, the vehicle 100 in which the electric storage device 110 and the engine 160 are mounted can perform (1) external power feed only using power of the electric storage device 110 (external power feed only by the electric storage device) under the control of the ECU 300. The vehicle 100 may use (2) only generated power of the motor generator MG1 by the driving of the engine 160 (external power feed only by the engine). The vehicle 100 may use (3) combined power of power of the electric storage device 110 and generated power of the motor generators MG1, MG2 (external power feed by the electric storage device and the engine).

[0030] (1) In case of external power feed only by the electric storage device, the converter 121 does not supply power to the power lines PL1, NL1. The power conversion device 200 receives and converts power from the power lines PL2, NL2 and supplies converted power to the power lines ACL1, ACL2. As a result, the electric storage device 110 is discharged to the power lines PL2, NL2.

[0031] (2) In case of external power feed only by the engine, the converter 121 supplies power to the power lines PL1, NL1. The power conversion device 200 receives and converts power from the power lines PL2, NL2 and supplies converted power to the power lines ACL1, ACL2. At this time, the converter 121 and the power conversion device 200 are controlled by the ECU 300 such that power supplied to the power lines PL1, NL1 by the converter 121 and power received from the power lines PL2, NL2 by the power conversion device 200 become equal. As a result, the electric storage device 110 is not discharged to the power lines PL2, NL2. Then, the electric storage device 110 is not charged from the power lines PL1, NL1. With this, it is possible to prevent the occurrence of power loss resulting from the charging and discharging of the electric storage device 110. In this control, although the electric storage device 110 is slightly charged and discharged, in the embodiment, it should be understood that microscopic charging and discharging is no included in the charging and discharging of the electric storage device 110. That is, the ECU 300 causes the engine 160 to drive the motor

generator MG1 and controls the vehicle 100 to supply generated power of the motor generator MG1 to the outside of the vehicle 100 without charging the electric storage device 110.

[0032] (3) In case of external power feed by the electric storage device and the engine, the converter 121 supplies power to the power lines PL1, NL1. The power conversion device 200 receives and converts power from the power lines PL2, NL2 and supplies converted power to the power lines ACL1, ACL2. At this time, power received from the power lines PL2, NL2 by the power conversion device 200 is greater than power supplied to the power lines PL1, NL1 by the converter 121. As a result, the electric storage device 110 is discharged to the power lines PL2, NL2.

[0033] The hybrid vehicle which is controlled by the control device for a hybrid vehicle according to the embodiment does not depend on the system of the hybrid vehicle. That is, the control by the control device for a hybrid vehicle according to the embodiment can be applied to a hybrid vehicle of a type in which external power feed only by the electric storage device, external power feed only by the engine, and external power feed by the electric storage device and the engine are possible.

[0034] FIG. 2 is a diagram illustrating the connection between the vehicle 100 and an electric apparatus outside the vehicle during external power feed. As shown in FIG. 2, when the vehicle 100 supplies power to an electric apparatus 700, a connector dedicated for power feed (power feed connector) 600 is used. The power feed connector 600 is provided with an output part 610 to which a power plug 710 of the external electric apparatus 700 can be connected. If the power feed connector 600 is connected to the inlet 220, the power lines ACL1, ACL2 on the vehicle 100 side and the output part 610 are electrically connected together through a power transmission part 620.

[0035] Referring to FIGS. 1 and 2, the ECU 300 is configured to recognize (or detect) the connection of the power feed connector 600 to the inlet 220. The recognition is performed using, for example, a switch (not shown) which operates with the connection of the power feed connector 600 to the inlet 220. The ECU 300 may be configured to perform communication with the outside of the vehicle 100 through the power feed

connector 600. For the communication, a signal, such as the above-described signal PISW, may be used. Alternatively, for the communication, power line communication (PLC) may be used. For example, if the power feed connector 600 is connected to the inlet 220, the vehicle 100 is set in an operation state (external power feed mode) in which external power feed is possible. For example, if the power feed connector 600 is disconnected from the inlet 220, the vehicle 100 ends the external power feed mode.

[0036] If the vehicle 100 is set in the external power feed mode, the ECU 300 places the CHR 210 in the on state, operates the power conversion device 200, and supplies power from the vehicle 100 to the electric apparatus 700. With this, external power feed is performed. While external power feed is performed, power from the electric storage device 110, generated power of the motor generator MG1 by the driving of the engine 160, or combined power is transmitted to the power conversion device 200. The power conversion device 200 receives power, converts power to a voltage and a current (power) required for an appropriate operation of the electric apparatus 700, and outputs the voltage and the current. The ECU 300 acquires information relating to the voltage and the current (required power) required for power supply to the electric apparatus 700 using communication with the ECU 300 and the outside of the vehicle 100.

[0037] FIG. 3 is a diagram illustrating an example of the details of the ECU 300 of FIG. 1. Referring to FIG. 3, the ECU 300 includes a temperature information acquisition unit 310, a determination unit 320, a control unit 330, and other circuits 340.

[0038] Referring to FIGS. 1 to 3, the temperature information acquisition unit 310 acquires temperature information transmitted from the temperature sensor 800. The acquired temperature information is transmitted to the determination unit 320.

[0039] The determination unit 320 receives the temperature information transmitted from the temperature information acquisition unit 310 and performs determination about whether or not the temperature of the electric storage device 110 exceeds a predetermined range. When the temperature information is the ambient temperature (outside air temperature) of the electric storage device 110, the determination unit 320 estimates the outside air temperature to be the temperature of the electric storage

device 110. This is because it is understood by the experiment or the like of the inventors that the temperature of the electric storage device is a temperature close to the ambient temperature (outside air temperature). The determination result of the determination unit 320 is transmitted to the control unit 330.

[0040] The control unit 330 receives the determination result of the determination unit 320 and controls power supply from the vehicle 100 to the electric apparatus 700. At this time, the control unit 330 takes the temperature of the electric storage device 110 into consideration. The reason that the temperature of the electric storage device 110 is taken into consideration will be described below referring to FIG. 4.

[0041] When the temperature of the electric storage device 110 is within the predetermined range, the control unit 330 selects an optimum external power feed operation among (1) external power feed only by the electric storage device 110, (2) external power feed only by the engine 160, and (3) external power feed by the electric storage device 110 and the engine 160. Which of the (1) to (3) external power feed operations is to be performed can be determined taking into consideration efficiency of the engine 160 in external power feed. For example, when power required for external power feed is comparatively small, it is considered that (1) external power feed only by the electric storage device 110 is suitable. When power required for external power feed is comparatively large, it is considered that (3) external power feed by the electric storage device 110 and the engine 160 is suitable. When the SOC of the electric storage device 110 is comparatively low, (2) external power feed only by the engine 160 may be selected.

[0042] When the temperature of the electric storage device 110 is outside the predetermined range, the control unit 330 gives priority to (2) external power feed only by the engine 160. When in this situation supply power is insufficient only by the engine, the control unit 330 may perform (3) external power feed by the electric storage device 110 and the engine 160.

[0043] Other circuits 340 include circuits which constitute a CPU, a storage device, an input/output buffer, and the like.

[0044] As described above referring to FIG. 1, the electric storage device includes,

for example, a secondary battery, such as a lithium ion battery, a nickel-hydrogen battery, or a lead storage battery, or an electric storage element, such as an electric double layer capacitor. The characteristics of this electric storage device change depending on the temperature. For example, if the temperature of the electric storage device is too high, the electric storage device may be deteriorated. The temperature of the electric storage device can be increased by power (discharged power) extracted from the electric storage device and power (charged power) input to the electric storage device. Accordingly, when the temperature of the electric storage device is too high, in order to prevent a further increase in temperature by charged/discharged power, a function of limiting charged/discharged power of the electric storage device is realized. If the temperature of the electric storage device is too low, charged/discharged power of the electric storage device is lowered.

[0045] FIG. 4 is a graph illustrating the relationship between chargeable/dischargeable power and a temperature of an electric storage device (for example, the electric storage device 110 of FIG. 1). In FIG. 4, the horizontal axis represents the temperature (°C) of the electric storage device, and the vertical axis represents an allowable output (kW). In the vertical axis, when the allowable output (kW) is positive, the value represents power (discharged power) which can be extracted from the electric storage device. Meanwhile, when the allowable output (kW) is negative, the value represents power (charged power) which can be input to the electric storage device. A temperature T1 is an upper limit temperature of the above mentioned predetermined range, while a temperature T2 is a lower limit temperature of the predetermined range.

[0046] Referring to FIG. 4, if the temperature of the electric storage device is equal to or higher than T2 (or a temperature close to T2) and equal to or lower than T1 (or a temperature close to T1), the allowable output becomes comparatively large. Meanwhile, if the temperature of the electric storage device exceeds T1 (or a temperature close to T1) or falls below T2 (or a temperature close to T2), the allowable output is limited. If the temperature of the electric storage device reaches a high temperature, for

example a temperature exceeding T1, the electric storage device may be deteriorated. For example, when the temperature of the electric storage device 110 is higher than T1 or lower than T2, the control unit 330 of FIG. 3 can give priority to (2) the external power feed operation only by the engine 160. With this, it is possible to limit the use frequency of the electric storage device and to prevent an increase in temperature of the electric storage device. When the temperature of the electric storage device 110 is equal to or higher than T2 and equal to or lower than T1, the control unit 330 can perform the external power feed operation including the use of the electric storage device. That is, the control unit 330 can select an optimum efficiency external power feed operation (optimum efficiency mode) among (1) the external power feed operation only by the electric storage device 110, (2) external power feed only by the engine 160, and (3) external power feed by the electric storage device 110 and the engine 160. With this, it is possible to improve efficiency of external power feed.

[0047] When the temperature of the electric storage device falls below T2, the control unit 330 controls the air conditioner 900 shown in FIG. 1. Specifically, the control unit 330 starts a heating function of the air conditioner 900. With this, the electric storage device is warmed. With this warming, if the temperature of the electric storage device becomes equal to or higher than T2, it becomes possible to perform the external power feed operation including the use of the electric storage device.

[0048] FIG. 5 is a flowchart illustrating control which is executed when power feed (external power feed) is performed from the vehicle 100 to the electric apparatus 700 of FIGS. 1 and 2. The process of the flowchart is executed by the ECU 300 of FIG. 1 or the like.

[0049] Referring to FIGS. 1 and 3 to 5, first, determination is performed about whether or not the vehicle 100 is set in the external power feed mode (Step S101). When the vehicle 100 is set in the external power feed mode (YES in Step S101), the process progresses to Step S102. When the vehicle 100 is not set in the external power feed mode (NO in Step S101), the flowchart ends.

[0050] In Step S102, determination is performed about whether or not the

temperature of the electric storage device, for example, the temperature (outside air temperature) outside the electric storage device measured by the temperature sensor 800 of FIG. 1 is lower than the predetermined temperature T1. When the outside air temperature is lower than the predetermined temperature T1 (YES in Step S102), the process progresses to Step S104. When the outside air temperature is equal to or higher than the predetermined temperature T1 (NO in Step S102), the process progresses to Step S103. In Step S103, power feed from the engine 160 is given priority, and power is supplied to the electric apparatus 700. Thereafter, the process returns to Step S101.

[0051] In Step S104, determination is performed about whether or not the outside air temperature is higher than the predetermined temperature T2. The predetermined temperature T2 in Step S104 is a temperature at which the allowable output of the electric storage device is limited to some extent. The predetermined temperature T2 is a temperature lower than the predetermined temperature T1. When the outside air temperature is higher than the predetermined temperature T2 (YES in Step S104), the process progresses to Step S106. When the outside air temperature is equal to or lower than the predetermined temperature T2 (NO in Step S104), the process progresses to Step S105.

[0052] In Step S105, power feed from the engine 160 is given priority, and the heating function of the air conditioner 900 is started. Thereafter, the process returns to Step S101.

[0053] In Step S106, power feed is performed in the optimum efficiency mode. After the heating function of the air conditioner 900 is started once in Step S105, the process may progress to Step S106 when performing a next control routine. In this case, in Step S106, if it is determined that the outside air temperature is higher than the predetermined temperature T2, the heating function of the air conditioner 900 may be stopped. Thereafter, the process returns to Step S101.

[0054] Finally, the embodiment of the invention will be summarized. Referring to FIGS. 1 and 3, the control device (ECU 300) for a hybrid vehicle according to the embodiment is used for the hybrid vehicle 100 in which the internal combustion engine

(engine 160), the rotating electric machine (motor generators MG1, MG2), and the electric storage device 110 are mounted, and external power feed is possible, and includes the temperature information acquisition unit 310 which acquires information relating to the temperature of the electric storage device 110, and the control unit 330 which, when the temperature of the electric storage device 110 exceeds the predetermined range, causes the internal combustion engine (engine 160) to drive the rotating electric machine (motor generators MG1, MG2) and controls the hybrid vehicle 100 to supply generated power of the rotating electric machine (motor generators MG1, MG2) to the outside of the hybrid vehicle 100 without charging the electric storage device 110, and when the temperature of the electric storage device 110 does not exceed the predetermined range, controls the hybrid vehicle 100 to supply power of the electric storage device 110 to the outside of the hybrid vehicle 100.

[0055] Preferably, an upper limit temperature of the predetermined range is a temperature (T1) under a condition in which the electric storage device is deteriorated or the output of the electric storage device is limited at a temperature higher than the upper limit temperature, and a lower limit temperature of the predetermined range is a temperature (T2) under a condition in which the output of the electric storage device is limited at a temperature lower than the lower limit temperature.

[0056] Preferably, information relating to the temperature of the electric storage device 110 is an air temperature outside the electric storage device 110.

[0057] Preferably, the air conditioner 900 is further mounted in the hybrid vehicle 100, and when the temperature of the electric storage device 110 is lower than the lower limit temperature (T2) of the predetermined range, the control device (ECU 300) controls the air conditioner 900.

[0058] According to the control device for a hybrid vehicle of the embodiment, it becomes possible to perform the external power feed taking into consideration the temperature of the electric storage device.

[0059] The embodiment disclosed herein is to be considered in all respects illustrative and not restrictive. The scope of the invention is indicated by the appended

claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein.

CLAIMS

1. A control device for a hybrid vehicle in which an internal combustion engine, a rotating electric machine, and an electric storage device are mounted, and which is able to perform external power feed, the control device comprising:

a temperature information acquisition unit which acquires information relating to the temperature of the electric storage device; and

a control unit which, when the temperature of the electric storage device is outside a predetermined range, causes the internal combustion engine to drive the rotating electric machine and controls the hybrid vehicle to supply generated power of the rotating electric machine to the outside of the hybrid vehicle without charging the electric storage device, and when the temperature of the electric storage device is within the predetermined range, controls the hybrid vehicle to supply power of the electric storage device to the outside of the hybrid vehicle.

2. The control device according to claim 1,

wherein an upper limit temperature of the predetermined range is a temperature under a condition in which the electric storage device is deteriorated or the output of the electric storage device is limited at a temperature higher than the upper limit temperature, and

a lower limit temperature of the predetermined range is a temperature under a condition in which the output of the electric storage device is limited at a temperature lower than the lower limit temperature.

3. The control device according to claim 1 or 2,

wherein information relating to the temperature of the electric storage device is an air temperature outside the electric storage device.

4. The control device according to any one of claims 1 to 3,

wherein an air conditioner is further mounted in the hybrid vehicle, and when the temperature of the electric storage device is lower than a lower limit temperature of the

predetermined range, the control device controls the air conditioner to warm the electric storage device.

5. The control device according to any one of claims 1 to 4, further comprising:

a determination unit receiving temperature information from the temperature information acquisition unit and performing determination about whether or not the temperature of the electric storage device exceeds the predetermined range,

wherein the control unit receives the determination result of the determination unit and controls power supply from the hybrid vehicle to the outside of the hybrid vehicle depending from the determination result.

6. A control method for a hybrid vehicle in which an internal combustion engine, a rotating electric machine, and an electric storage device are mounted, and which is able to perform external power feed, the control method comprising:

acquiring information relating to the temperature of the electric storage device;

when the temperature of the electric storage device is outside a predetermined range, causing the internal combustion engine to drive the rotating electric machine and controlling the hybrid vehicle to supply generated power of the rotating electric machine to the outside of the hybrid vehicle without charging the electric storage device, and

when the temperature of the electric storage device is within the predetermined range, controlling the hybrid vehicle to supply power of the electric storage device to the outside of the hybrid vehicle.

7. The control method according to claim 6,

wherein an upper limit temperature of the predetermined range is a temperature under a condition in which the electric storage device is deteriorated or the output of the electric storage device is limited at a temperature higher than the upper limit temperature, and

a lower limit temperature of the predetermined range is a temperature under a condition in which the output of the electric storage device is limited at a temperature lower than the lower limit temperature.

8. The control method according to claim 6 or 7,

wherein information relating to the temperature of the electric storage device is an air temperature outside the electric storage device.

9. The control method according to any one of claims 6 to 8,

wherein an air conditioner is further mounted in the hybrid vehicle, and

when the temperature of the electric storage device is equal to or lower than a lower limit temperature of the predetermined range, the air conditioner is controlled to warm the electric storage device.

10. The control method according to any one of claims 6 to 9, further comprising:

performing determination about whether or not the temperature of the electric storage device exceeds the predetermined range based upon acquired information relating to the temperature of the electric storage device, and

controlling the supply of power from the hybrid vehicle to the outside of the hybrid vehicle depending from the determination result.

11. A hybrid vehicle comprising:

an internal combustion engine,

a rotating electric machine driven by the international combustion engine,

an electric storage device,

a control device according to any one of claims 1 to 5, and

a temperature sensor detecting a temperature of the electric storage device and transmitting a measurement value of the temperature to the control device.

12. The hybrid vehicle according to claim 11, wherein the temperature sensor detects the temperature of the electric storage device by measuring the temperature of the electric storage device or by measuring an ambient temperature of the electric storage device.

13. The hybrid vehicle (100) according to claim 11 or 12, further comprising an air conditioner.

FIG. 1

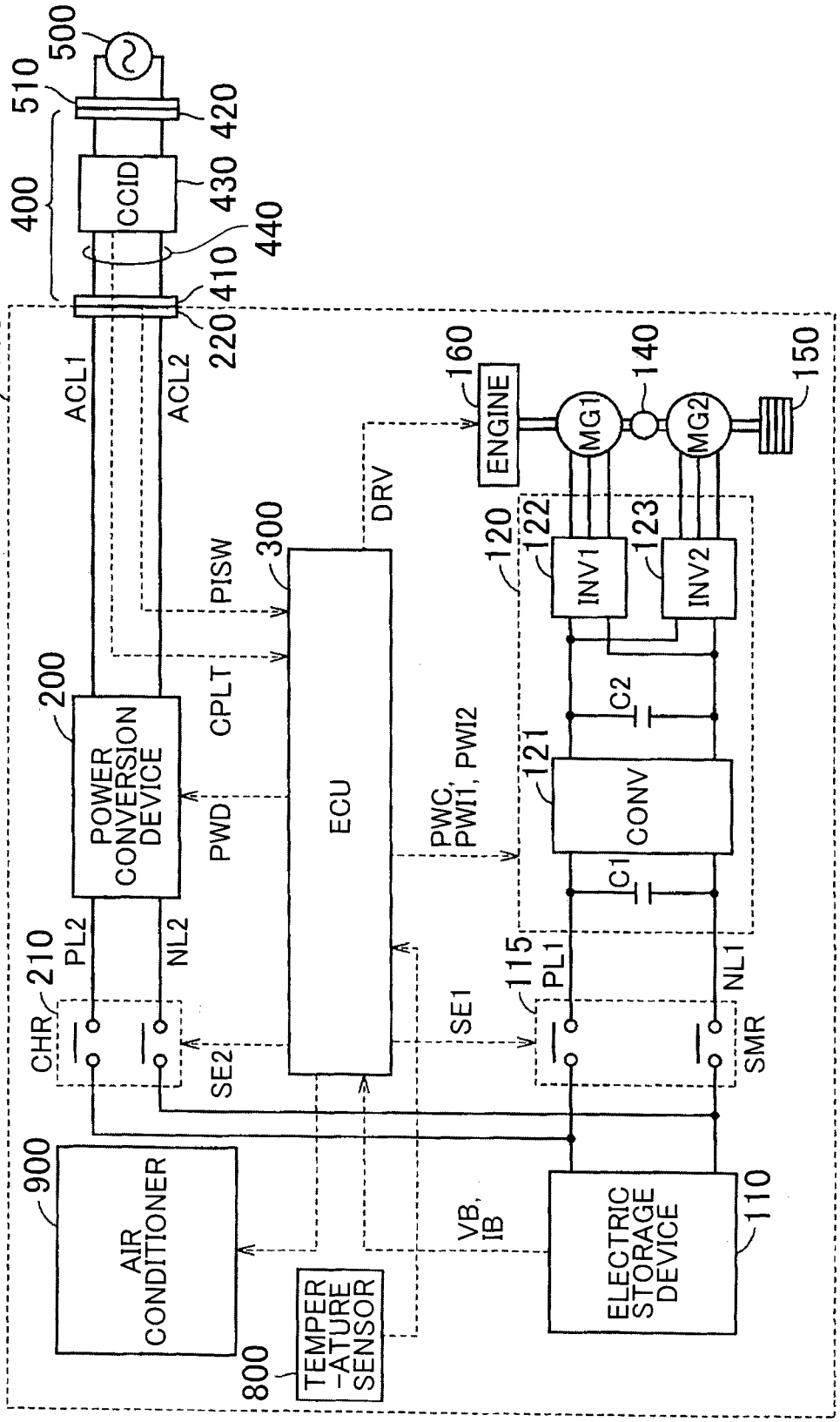

500
510
420
400
CCID
430
440
410
220
100
ACL1
ACL2
160
ENGINE
140
MG1
MG2
150
DRV
300
PISW
120
122
123
INV1
INV2
200
POWER CONVERSION DEVICE
CPLT
C2
121
CONV
PWD
ECU
PWC, PWI1, PWI2
C1
210
PL2
NL2
CHR
115
PL1
NL1
SE1
SE2
SMR
900
AIR CONDITIONER
VB, IB
ELECTRIC STORAGE DEVICE
110
800
TEMPER -ATURE SENSOR

FIG. 2

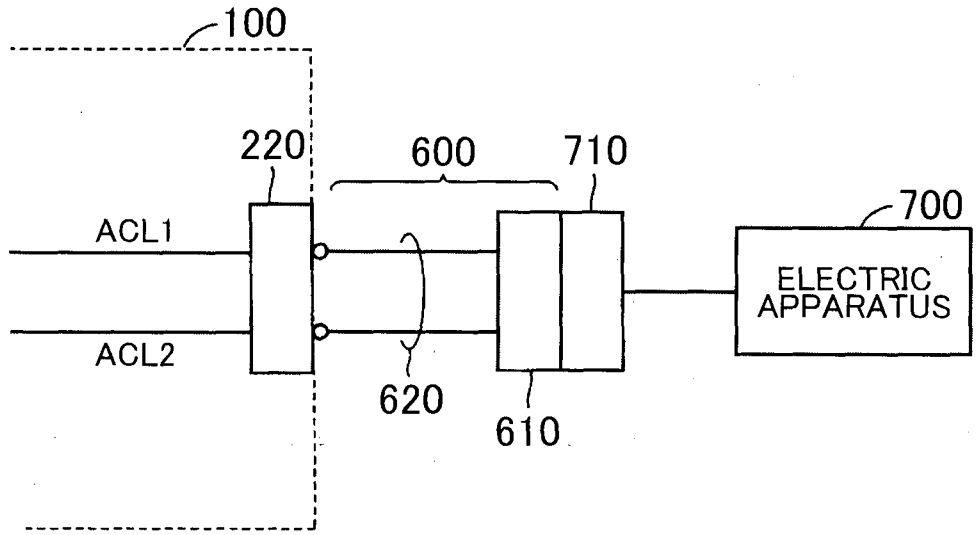


FIG. 3

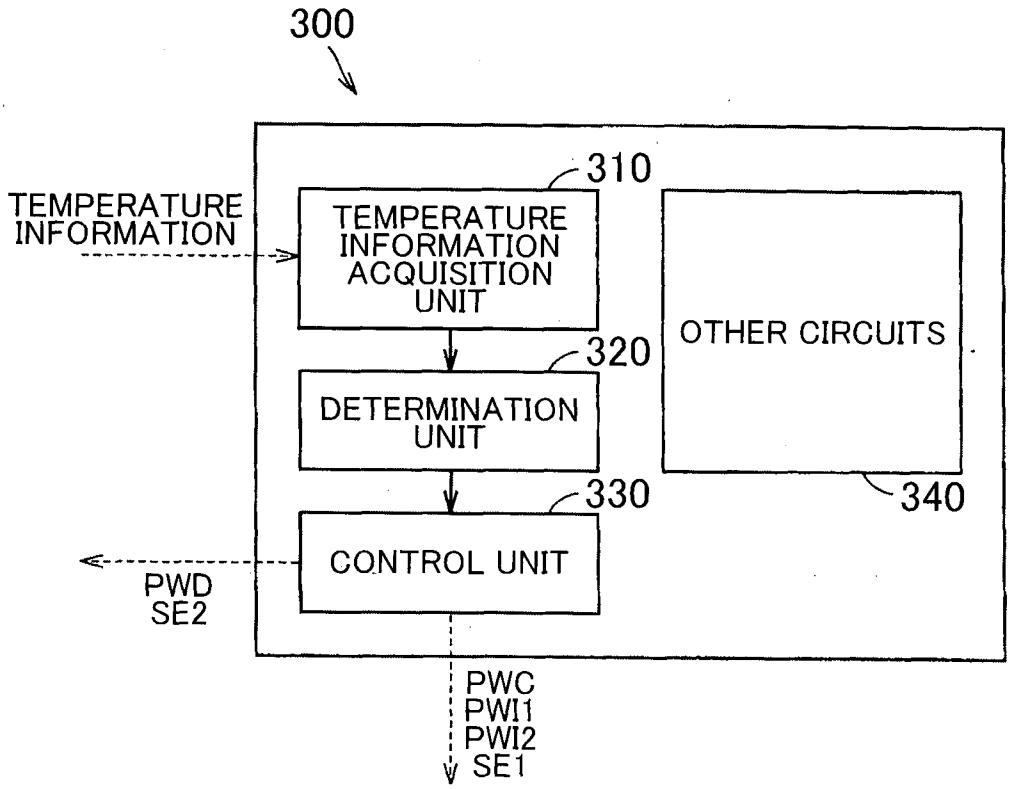

300
310
TEMPERATURE INFORMATION
TEMPERATURE INFORMATION ACQUISITION UNIT
OTHER CIRCUITS
320
DETERMINATION UNIT
330
340
CONTROL UNIT
PWD
SE2
PWC
PWI1
PWI2
SE1

FIG. 4

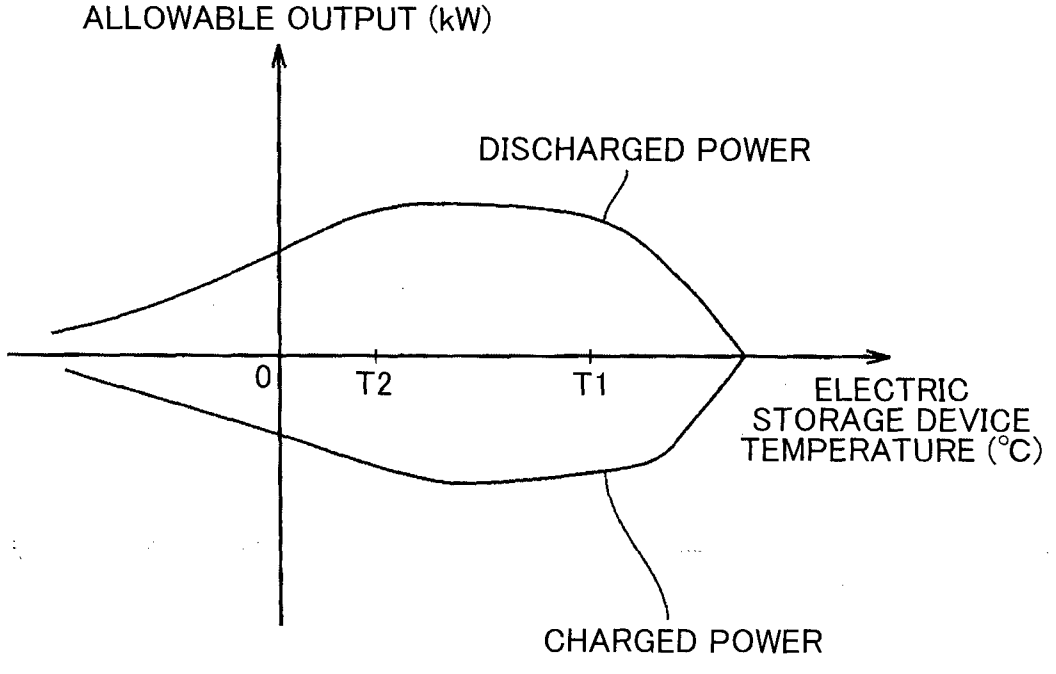
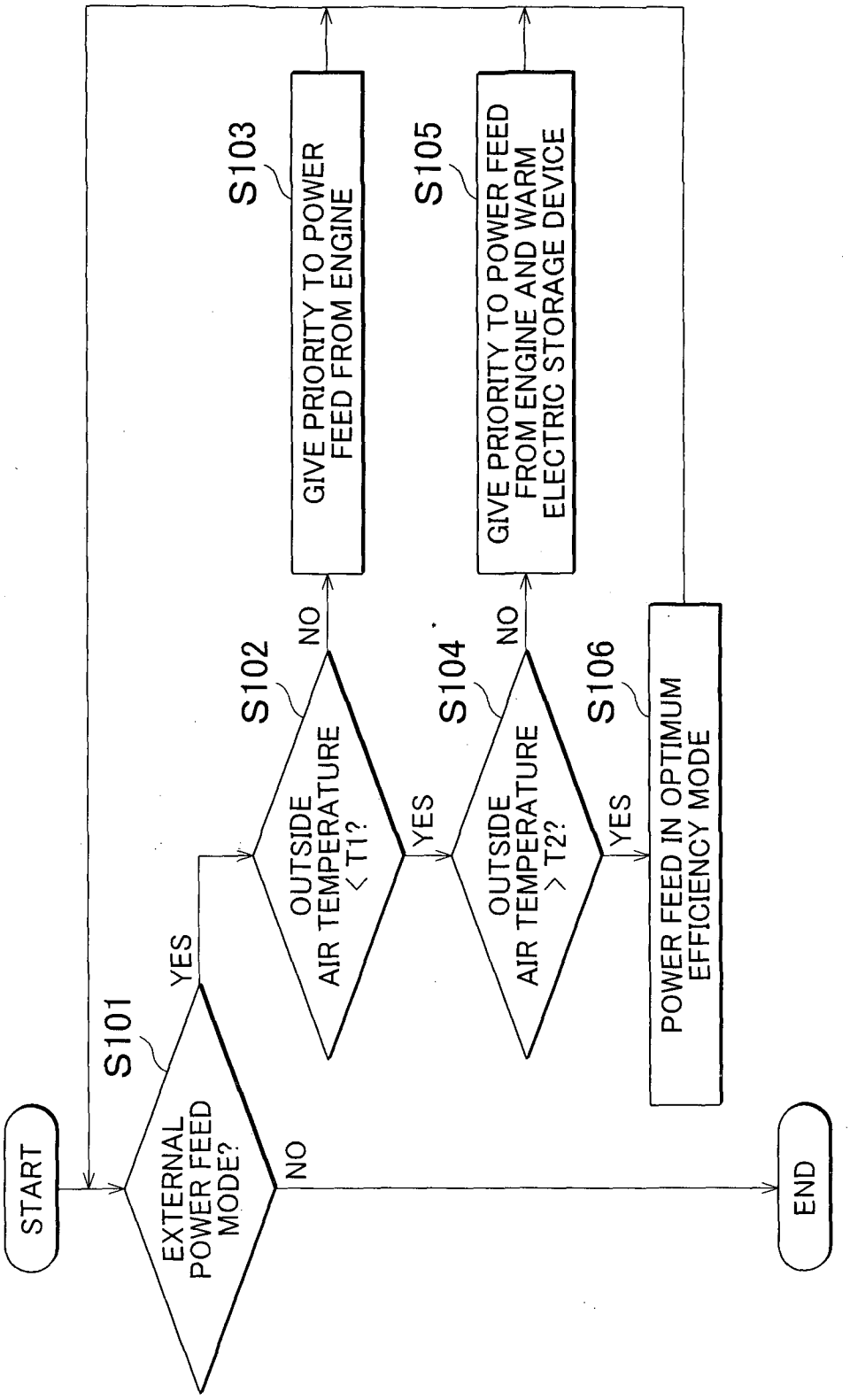

ALLOWABLE OUTPUT (kW)
DISCHARGED POWER
0
T2
T1
ELECTRIC STORAGE DEVICE TEMPERATURE (°C)
CHARGED POWER

FIG. 5


START
S101
EXTERNAL POWER FEED MODE?
YES
NO
S102
OUTSIDE AIR TEMPERATURE < T1?
YES
NO
S103
GIVE PRIORITY TO POWER FEED FROM ENGINE
S104
OUTSIDE AIR TEMPERATURE > T2?
YES
NO
S105
GIVE PRIORITY TO POWER FEED FROM ENGINE AND WARM ELECTRIC STORAGE DEVICE
S106
POWER FEED IN OPTIMUM EFFICIENCY MODE
END

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/001893

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60L11/12 B60L11/18
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)
B60L

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X Y	US 2010/164287 A1 (KOMAZAWA EISUKE [JP] ET AL) 1 July 2010 (2010-07-01) figure 7 paragraph [0034] paragraph [0089] - paragraph [0104] claim 4	1,3-6, 8-13 2,7
Y A	EP 2 177 389 A1 (TOYOTA MOTOR CO LTD [JP]; AISIN AW CO [JP]) 21 April 2010 (2010-04-21) figures 4,5 paragraph [0062] - paragraph [0066] paragraph [0088]	2,7 3,8,12
A	US 2013/231811 A1 (AOKI TAKANORI [JP]) 5 September 2013 (2013-09-05) figure 9 paragraph [0055] - paragraph [0057]	1,6

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 January 2015	03/02/2015

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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		US 2013231811 A1	05-09-2013